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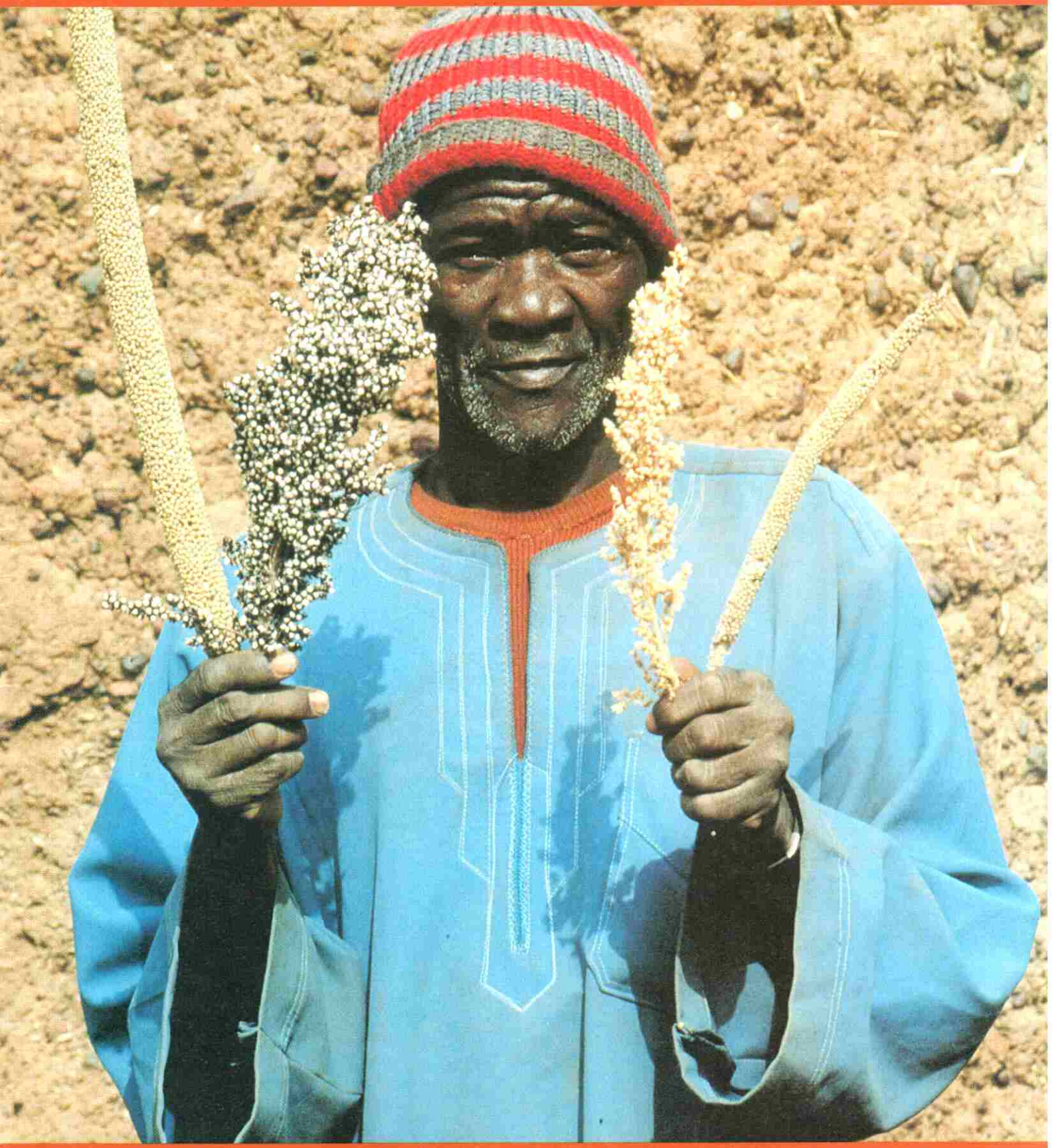
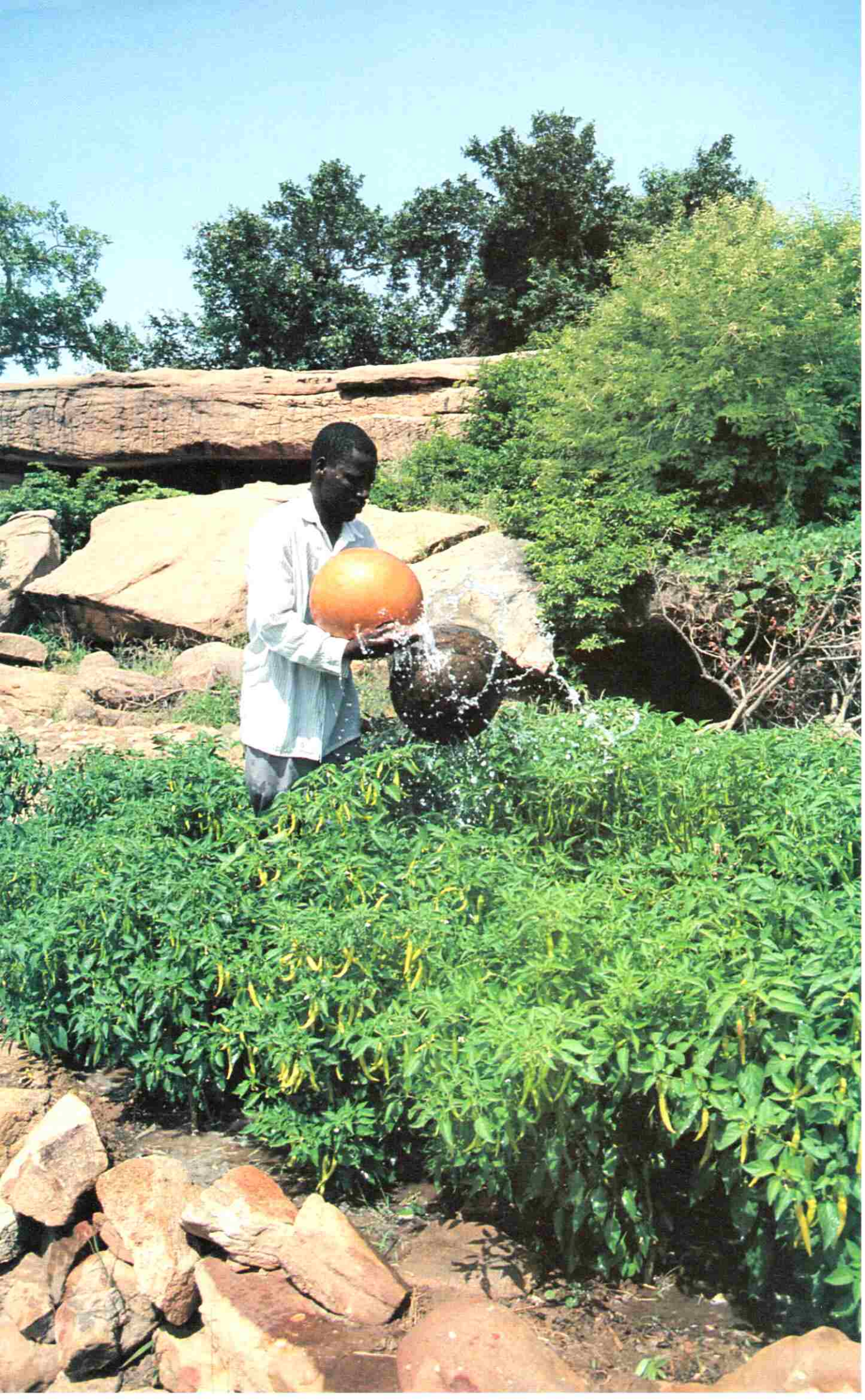
# People & the Planet

Volume 7 Number 1



## SUSTAINING THE SOIL



**Front cover:** Millet heads & sorghum grown in a good and bad year, Burkino Faso
**Credit:** Mark Edwards/Still Pictures
**Left:** Dogon market gardening, Mali
**Credit:** Paul Harrison

# People & the Planet

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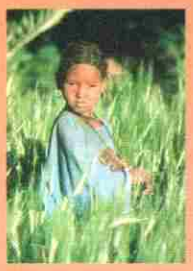


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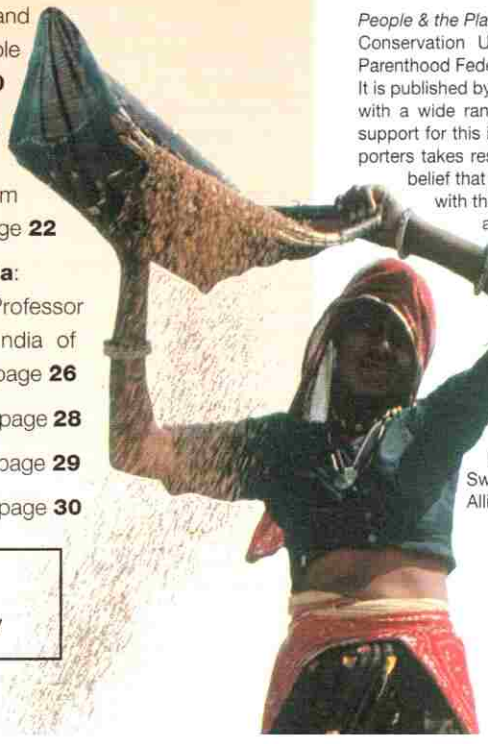
*People & the Planet* may be accessed on the Internet: **http://www.oneworld.org/patp/**



# Showing the way

This issue of *People & the Planet* carries an important message. Research from every region of the developing world shows that peasant farmers can greatly increase yields, and improve the fertility of their land, using a wide variety of traditional and modern techniques – without heavy dependence on chemical fertilisers and pesticides. The evidence for this has been built up from dozens of country and regional programmes and thousands of small-scale projects. But it is only in the last year or so that researchers from the International Institute of Environment and Development (IIED) and elsewhere, have begun to bring it all together in books such as Jules Pretty's *Regenerating Agriculture* and the more recent report from Africa's drylands, *Sustaining the Soil* (see pages 20 and 30). In this issue, we also draw on the wider net cast by the IIED's Sustainable Agriculture Programme, which looked at the lessons from over 100 programmes and projects in Africa, Asia and Latin America. The conclusions from this are illustrated by specially commissioned reports from all three continents.

The scale of the challenge, in a world where 800 million people are severely malnourished, where 1.3 billion survive in abject poverty, where the resources of water and land are under severe stress, and where an additional 80 million mouths need to be fed every year, is set out in Don Hinrichsen's overview. The positive news is contained in the articles that follow. These show that the UN Food and Agriculture Organisation's forecast of 650 million badly malnourished people by the year 2010 – with a 300 million suffering from hunger in Africa alone – need not come to pass, if the necessary investment in sustainable, participatory small-scale agriculture is made.

There are other lessons on which all our contributors are agreed. Achieving food security is more than a matter of food production. It cannot be divorced from the questions of poverty, conflict, corruption, gender equality, population and the environment. It is also a question of livelihood security: having the means to earn the money to buy the food, if not grow it. Developing 'off farm' activities and the marketing of food, while adding value to it wherever possible, are all part of the solution. As the State contracts, farmers and communities are going to have to develop their own resources, drawing on the best management information they can. Dr Swaminathan's biovillages in India, which he describes here, are already showing the way.

**John Rowley**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The following 'associates' are partners in the development and distribution of *People & the Planet:* AVSC International, Audubon, Center for Communication Programs, John Hopkins School of Public Health, Earthwatch, Centre for Development and Population Activities, Family Health International, Futures Group, International Institute for Environment and Development, International Union for the Scientific Study of Population, Pathfinder International, Population Action International, Population Concern, Population Reference Bureau, Royal Swedish Academy of Sciences, Television Trust for the Environment, WWF-Alliance for Religions and Conservation.

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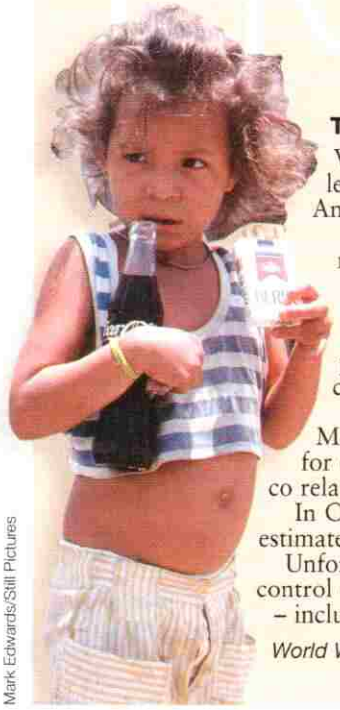
# newsfile



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## TOBACCO EPIDEMIC

Within 25 years, tobacco induced illness is expected to overtake infectious disease as the leading threat to human health worldwide, according to Worldwatch Institute researcher, Anne Platt McGinn.

Writing in *World Watch* magazine, she reports that the consumption of tobacco has now reached the proportions of a "global epidemic," with tobacco companies cranking out 5.5 trillion a year – or nearly 1,000 cigarettes for every man, woman and child on the planet.

Sales are boosted by the big-budget marketing strategies of the seven leading multinational tobacco companies, often targeting teenagers. In the United States, for example, the popularity of the Joe Camel cartoon character has seen the value of Camel cigarette sales to children under 18 jump from $6 million to $476 million in two years.

Governments as well as individuals are getting hooked on tobacco, says Anne Platt McGinn, as tax revenues create higher degrees of dependency. But this is a false economy as for every 1,000 tons of tobacco produced, nearly 1,000 people will eventually die from tobacco related illnesses.

In China alone research puts the health costs of smoking at over $11 billion in 1993. And it is estimated that 2.5 million Chinese will die of cigarette-caused disease by 2020.

Unfortunately, of 80 members of the world community who voted on an international tobacco control convention at the World Health Organisation last year, five countries refused to approve it – including the United States which is the world's second leading source of exported cigarettes.

*World Watch* Vol 10, No 4, 1997.

## POLLUTING PLANES

Environmental organisations in 16 European countries demonstrated at airports on December 5-6 to draw attention to the environmental consequences of air transport. The action day was part of a joint European campaign – The Right Price for Air Travel.

The organisers argue that European governments keep the price of flying artificially low. Airplane tickets, fuel for airplanes (kerosene) and transport of goods by air all have no Value Added Tax. There are no environmental charges for kerosene and, unlike petrol, there are no excise duties.

Meanwhile, air traffic in Europe is set to grow by 6 per cent a year in the coming decades. By 2015, planes are expected to have doubled their current contribution of 3-5 per cent to the global greenhouse effect. Airplanes emit nitrogen oxides (NOx), which not only contributes to acid rain, but also damages the ozone layer at high altitudes. Scientists predict that by 2015 half of the annual destruction of the ozone layer will be caused by air traffic.

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## DESERT WATERS

One year ago, in January, President Hosni Mubarak of Egypt set off an explosion at Toshka on the banks of Lake Nasser to mark the first phase of a visionary project which could make the Western Desert bloom and "change the face of life in Egypt." The plan is to pump nearly six billion gallons of Nile water a day from Lake Nasser into a canal running northwest across the uninhabited desert, creating a lush region called the New Valley.

Since then, work has gone ahead on a huge pumping station which will lift 66,000 gallons of water a second, and deposit it into a canal to be cut 150 miles across the desert. This would irrigate 500,000 acres in the first phase alone, opening up huge new tracts of farmland.

That at least is the plan, which if successful would relieve the enormous pressure on the narrow strip of Nile territory, comprising just 4 per cent of the country, which houses some 90 per cent of Egypt's 62 million people.

With population projected to reach 85 million by 2015, Mr Mubarak and his supporters believe it is time to leave the 'old valley' behind.

However, critics fear that the scheme would squander the river's limited water through high rates of evaporation, even if enough could be found to fill the canal. Already Egypt is using every drop of the 55.5 billion cubic metres of Nile waters it is allowed under agreement with Sudan and Ethiopia.

As it is, only a relative trickle (or some 300 million cubic metres) of Nile water reaches the Mediterranean – one-fifth of the volume five years ago. And one estimate predicts that Egypt will be short of some 27 billion cubic metres of water a year by 2025, even if the scheme does not go ahead.

With construction costs at $810 million, mainly for the pumping station, and a total budget of $2 billion, it remains unclear whether this new project does mark a "new era" for Egypt, as the government claims, or is merely a mirage.

According to Tony Allan of the University of London School of Oriental and African Studies, the plan is "preposterous and a national fantasy." He points out that as Ethiopia and Sudan are planning to build more impoundments on the Upper Nile, Egypt "is going to have less water (in the future), not more."

*New York Times*, January 10, 1997 and *World Rivers Review*, June 1997.
See also *Troubled Waters of Eden*, *People & the Planet* (Vol 5, No 3, 1996).

## PESTICIDE WATCH

Five extremely hazardous pesticides have been added to an existing watch list so that their trade can be better monitored and managed in future. Certain highly concentrated formulations of five pesticides known as organophosphates – methamidophos, methyl parathion, monocrotophos, parathion and phosphamidon – join 17 harmful pesticides and 5 industrial

Mark Edwards/Still Pictures

chemicals which are already part of what is known as the Prior Informed Consent Procedure (PIC).

According to this voluntary system, these dangerous substances should not be exported without the agreement of the importing country. PIC is jointly administered by FAO and UNEP. Currently, 154 countries are participating in the PIC procedure.

Studies on the application of organophosphates have shown that during normal spraying, farmers are exposed to contamination by absorption or residues on clothing through the skin. In China alone, 27 provinces in 1995 reported a total of 48,377 poisoning cases, including 3,204 fatalities.

Reports have shown that consumers have also been at risk of acute poisoning following the consumption of green leafy vegetables that had been treated shortly before harvest with organophosphate pesticides.

"The inclusion of these five pesticides is a big step forward in the implementation of the voluntary PIC procedure," said Jim Willis, Director of UNEP's Chemical Programme. "It should also give an added impetus to the coming talks on a legally binding instrument, which should be finalised by mid-1998."

The global market for pesticides continues to grow and is estimated at $30 billion in 1996. The fastest growing markets are in the developing world, particularly Latin America and Asia. In China, the production of organophosphorus insecticides totalled 177,900 tons in 1995, an increase of 28 per cent over the previous year. Dramatic shifts to intensive pesticide use on export crops is occurring in Africa as well.

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## FOOD SLOWDOWN

First estimates for world crop and livestock production in 1997 put the expansion in global agricultural production in 1997 at only 1.1 per cent, a significant slowdown in production growth compared to a relatively buoyant 3.6 per cent in 1996.

At the same time, the UN Food and Agriculture Organisation (FAO) reports that food aid in 1996/97 dropped sharply by 37 per cent to 4.9 million tons, the lowest level since the start of food aid programmes in the mid-1950s, while official development assistance to agriculture continued to decline for the eleventh year.

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## BAKUN SHELVED

The announcement, in September, that Malaysia's controversial Bakun Dam would be "indefinitely postponed" makes it unlikely that the project will be financed in the foreseeable future, according to observers close to the project.

But they fear that the logging of the reservoir area by the Malaysian company operating the project, Ekran Berhad, and resettlement of 10,000 indigenous people living there, may still go ahead.

The announcement of the delay came a day after Ekran cancelled its contract with the consortium which was to have built the dam, led by Swiss-Swedish engineering firm Asea Brown-Boveri (ABB). Ekran's chairman, Ting Pek Khling, said that he was having talks with another construction consortium, but the London *Financial Times* predicts it "could be years at least" before the scheme could be revived.

The shelving of the dam is part of a package of austerity measures intended to restore investor confidence in the Malaysian economy following a big drop in the value of the currency and in the Kuala Lumpur stock market.

*World Rivers Review*, Vol 12, No 5, obtainable from International Rivers Network, 1847 Berkeley Way, Berkeley, CA 94703, USA.

## BIRTH PAINS

Thousands of Nigerian women are dying in pregnancy or childbirth because they are unable to pay hospital and clinic fees for antenatal care and delivery, *writes Mary Kanu.*

The average Nigerian earns $260 per year, which means most cannot afford the fees charged by clinics. Average antenatal care and a normal delivery costs nearly $50, not counting the cost of drugs and laboratory tests. The average cost of having a baby in a military hospital is $150.

Maternal mortality rates in Nigeria are among the highest in the world, with the United Nations estimating that 1,000 women die for every 100,000 live births (half the deaths, however, are due to unsafe and illegal abortions).

The Nigerian government introduced user-fees for healthcare in the mid-1980s as part of a structural adjustment programme (SAP) supported by the International Monetary Fund and the World Bank. As in many other developing countries, its impact on the Nigerian poor has been catastrophic. Prices of basic goods and services have shot up; school education and healthcare – once free or subsidised – now cost money; wages have fallen and unemployment has risen.

State funding for hospitals has been cut drastically. In 1987 – the last year for which figures exist – the government spent only 0.8 per cent of its budget on health.

Experts in Nigeria believe high user-fees are increasing the numbers of maternal deaths. When researchers looked at records at the Ahmadu Bello University Teaching Hospital in the northern city of Zaria between 1985 and 1988, they found that maternal deaths rose by 56 per cent. At the same time, there was a fall in childbirth admission from 7,450 in 1983 (when maternal care was free) to 5,437 two years later when some user-fees were introduced, and to 3,376 in 1988, when patients had to pay for most of the materials needed for treatment.

And if there are complications at delivery (approximately two-thirds of Nigerian women give birth without a trained midwife or traditional birth attendant), women delay going to hospital while family members beg and borrow money and provisions. By the time they are admitted, it is often too late. Young mothers denied antenatal care and medical assistance at birth are particularly vulnerable.

Researchers found that when hospital deliveries dropped, there was a surge in emergency admissions for women with ruptured uteruses and damaged bladder and rectum caused by obstructed labour. Other research shows that more infants die when women at risk deliver at home.

According to Dr David Olurin, Co-ordinator of the Safe Motherhood Movement which was launched by the Society of Gynaecologists and Obstetricians, high fees in government facilities are "unacceptable, dangerous and unfair," punishing women for the social act of childbearing.

Panos Features, October 10, 1997.
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Bruce Paton/Panos Pictures

John E. Newby/WWF

Although some experts are confident that a future world of eight or ten billion people will be able to feed itself, others share grave concerns about the future sustainability of current farming practices – especially in poor, food-deficit countries with growing populations. **Don Hinrichsen** reviews the latest evidence.

# Feeding a future world

There are three worlds when it comes to agricultural production: the haves, the poor have-nots and the rich have-nots. The haves – North America, Europe, and Australia – have sufficient cropland to meet most of their food needs and efficient agricultural production systems enabling them to produce more food from the same amount of land.

These countries share some common characteristics: they have reached a demographic transition to lower fertility rates, they are net food exporters, they are probably capable of expanding food production beyond current levels, and they are moving, however slowly, towards more sustainable agricultural production systems.

The poor have-nots consist of the bulk of the developing world – nearly all of sub-Saharan Africa, seven countries in Latin America, seven in the Middle East, six in Oceania, with most of the rest in South and Central Asia. These countries contain more than half of humanity, over three billion people, and for many reasons cannot produce nor import enough food for their populations. In many cases their food production capacities are deteriorating in the face of rapid population growth, misdirected agricultural policies and widespread land degradation.

The third group is a mixed bag. It includes land-short Japan and Singapore, two of the world's richest economies, along with rapidly developing countries such as China and Indonesia in Asia, Peru and Chile in Latin America and Saudi Arabia and the other Gulf States in the Middle East. These countries, diverse as they are, share one common denominator: they cannot grow enough food to feed their populations, but have the financial resources to make up the shortfall through imports. All are struggling to improve agricultural systems and make them more efficient.

Japan is an anomaly. It can probably expand rice production, but current prices make it far cheaper for Japan to import additional rice rather than grow it on increasingly expensive land at home.

Despite the fact that the world grain harvest tripled between 1950 and 1990, keeping well ahead of population growth, it has tapered off dramatically in the last seven years. However, during the same period that grain yields continued to increase, the amount of grain area per person was declining. This is a reflection both of population growth and the loss of cropland due to urban expansion, soil degradation and a number of other factors. In 1950, the world averaged 0.23 hectares per person. By the mid-1990s that had been whittled away to just 0.13 hectares.

The world's population is now 5.8 billion, growing by over 80 million a year. The sixth billionth inhabitant will be born sometime during 1999. Most of this growth is concentrated in those developing countries least able to cope with the resource and food consequences of such growth. Lester Brown, President of the Worldwatch Institute in Washington DC, is worried. "Both the area of cropland and the amount of irrigation water per person are shrinking," he points out, "threatening to drop below the level needed to provide minimal levels of food security."

Some other experts are more sanguine

Mark Edwards/Still Pictures

about the long-term prospects, but with some promising exceptions, most of the world is not headed in the direction of sustainable agriculture. And the following problems are making the quest for sustainable food production systems even more difficult.

### Limited land

Although the amount of potentially arable land is 40 per cent more than is currently cultivated, according to the UN Food and Agriculture Organisation (FAO) – an extra two billion hectares – most of the uncultivated land is marginal, with poor soils and either too little rainfall or too much of it. Bringing it into production would require costly irrigation systems, or large-scale soil fertility enhancement measures. Without massive technological change or substantial investments, increases in food production will have to come from existing agricultural land.

### Smaller farms

One effect of rapid population growth is the shrinking size of family farmsteads. In most developing countries the size of small family farms has been halved over the past four decades, as plots are divided into smaller and smaller pieces for each new generation of male heirs. In 57 developing countries surveyed by the FAO in the early 1990s, over half of all farms were found to be less than one hectare, not enough to feed a family with four to six children. In India, three-fifths of all farms are less than one hectare.

At the same time, control over farmland is increasingly concentrated in the hands of large-scale farmers. In Guatemala, for example, only 3 per cent of farmers control 65 per cent of the most productive agricultural land. In some countries production of export crops has taken priority over food crops, a policy that favours large-scale, commercial agriculture. It also makes rural people more vulnerable to shifts in markets and fluctuating prices.

### Degrading land

Nearly two billion hectares of crop and grazing land is suffering from moderate to severe soil degradation, an area larger than the United States and Mexico combined. Soil erosion from wind and water is the main agent of soil degradation. Every year, some 25 billion metric tons of topsoil is stripped away from the world's farmland; five billion is lost in China alone.

Much of this soil is washed into rivers and streams, where it clogs waterways and snuffs out aquatic life. China's Huang (Yellow) River empties 1.6 billion metric tons of soil a year into the Yellow Sea. The United States has lost a third of its topsoil since colonial times. Researchers in the Philippines estimate that 1.2 million hectares of cropland – one-third of the total hectarage – have been severely degraded from the over-use of pesticides and chemical fertilisers.

On an annual basis, soil erosion and other forms of land degradation now rob the world of 5-7 million hectares of farming land. Globally, land degradation threatens the livelihoods of at least one billion people, the majority of them in poor developing countries.

Desertification, the process by which productive drylands become wasteland, now affects about 2.6 billion hectares of range land, just over 60 per cent of the total. Agricultural, forestry and livestock losses on drylands amount to over $40 billion a year, according to one estimate by the UN Environment Programme. The Institute of Soil Management in Kazakstan has estimated that the country will lose 30 per cent of its grain land to soil erosion and desertification. Globally, the livelihoods of 800 million to one billion people are at risk from the insidious processes of desertification.

### Irrigation troubles

Although only 17 per cent of all cropland is under irrigation, these lands produce a full one-third of the world's total food supply. However, due to badly planned and poorly built irrigation systems, the yields on one half of all irrigated land – amounting to around 120 million hectares – have fallen in recent years.

There are two main reasons for this: salinization and waterlogging of crops. In many dry, arid areas, salts that naturally occur in the soil must be drained away with irrigation runoff. If not, they accumulate in the soil, eventually working their way to the surface killing crops and poisoning the land. By the same token, improperly drained irrigation water can also raise the groundwater table until it reaches the root zone, drowning the crops.

The FAO estimates that salt build–up in soil has severely damaged 30 million hectares of the world's 240 million hectares of irrigated land. Another 80 million hectares are affected by a combination of salinization and waterlogging. Salinity has cut yields on nearly one-quarter of China's irrigated land and 21 per cent of Pakistan's. These trends are alarming considering that more than 60 per cent of the value of Asian food crops comes from irrigated agriculture.

Improving irrigation efficiencies would help reduce the twin scourges

**Above left: Tuareg girl in ripening wheat, Niger**
**Below: Villagers working together preparing the ground for planting, Haiti**

Don Hinrichsen

of salinization and waterlogging. Currently, on average, no more than 50 per cent of water withdrawn for irrigation purposes actually reaches the crops. It soaks into unlined irrigation canals, leaks out of pipes and evaporates on its way to the fields.

The resulting loss of irrigated cropland has led David Seckler, Director General of the International Irrigation Management Institute to conclude that such losses may be exceeding the gains, leading to a shrinkage of the world irrigated area.

### Water shortages

The world's emerging crisis in irrigation is ultimately a water crisis. Water, after all, is a finite resource. There is only so much circulating in the world's hydrological cycle. Already, most of Africa and the Middle East, much of western United States and northwest Mexico, parts of Chile and Argentina, and nearly all of Australia suffer water shortages.

Scientists, like hydrologist Malin Falkenmark of Sweden, have calculated that in 1990, 28 countries containing 335 million people faced chronic water stress or outright scarcity. By 2025, water shortages may plague up to 52 countries, affecting as many as 3.2 billion people; roughly 40 per cent of the projected global population.

Africa and the Middle East are already experiencing acute shortages. Over the decade of the 1990s Kenya's per capita water supply will be cut in half and Egypt will have only two-thirds as much for its citizens. By the year 2000, six of East Africa's seven countries and all five nations on the south rim of the Mediterranean will face critical water shortages.

Collectively, the 20 countries comprising the Middle East and North Africa face the worst shortages. Today, annual per capita water availability is only 1,250 cubic metres, 60 per cent less than in 1960. By 2025, per capita supplies are expected to fall to 650 cubic metres, a further 50 per cent drop. Jordan and Yemen already withdraw 30 per cent more water from their groundwater aquifers every year than is being replenished.

Water woes are affecting a number of countries in Asia as well. Excessive pumping of groundwater for agriculture in Tamil Nadu, one of India's southern states, caused the water table to drop close to 30 metres in a decade. In the north Indian state of Uttar Pradesh the number of water-short villages soared from 17,000 to 70,000 in two decades; of 2,700 water wells supplied by the government, 2,300 have dried up. Across northern China, 300 cities now experience water shortages during all or part of the year; Beijing's water table is sinking at the rate of about two metres a year and a third of the city's wells have dried up.

The other problem with water supplies is that they are becoming increasingly polluted. Surface waters in many countries, developed and developing alike, are horribly polluted with untreated or partially treated municipal and industrial wastes and agricultural runoff (from fertilisers, pesticides and animal wastes). By the turn of the century, the world is expected to be generating 2,300 cubic kilometres of wastewater a year. Since it takes at least 10 times that amount to dilute pollutants the old phrase, "the solution to pollution is dilution", takes on rather grotesque connotations.

Nearly all of India's rivers have been turned into open sewers. Out of 78 major rivers in China, 54 are seriously polluted. More than 40 of Malaysia's rivers are so fouled with municipal, industrial and agricultural wastes that they are biologically dead.

Since 70 per cent of all water withdrawn every year is used for irrigated agriculture, current and expected water shortages, combined with loss of water quality from pollution, are emerging as major constraints on development in general and food production in particular.

### Collapsing fisheries

While land-based food systems are under pressure, the harvest from the sea has already peaked.

During the last three decades the reckless expansion of the world's fishing fleet, coupled to quantum leaps in fishing technologies and a dim understanding of fish population dynamics and ecosystem interactions has led to the over-exploitation of nearly every commercial fishery in the world's seas.

By 1995, according to FAO, nearly 70 per cent of the world's marine fish stocks were either "fully-to-heavily exploited, over-exploited, depleted or slowly recovering." Only a concerted international effort, perhaps led by the UN, can offer hope for better management of fish stocks.

### Genetic diversity

Meanwhile, plant breeders are alarmed about the continuing genetic erosion of the earth's wild strains of cereals and other cultivars.

After 10,000 years of settled agriculture and the discovery of some 50,000 varieties of edible plants, 15 provide 90 per cent of the world's food energy intake. Just three of them –

### FARMING: A VIEW FROM THE BOTTOM

Population growth has contributed directly to the shrinking size of small farm holdings in over 80 developing countries. In some cases new farming methods have enabled yields to grow, but increasingly poor farmers are forced off the land and into urban areas in search of employment. One man's story highlights the problems faced every day by millions of small-scale and subsistence farmers. The failure of governments to address the needs of poor farmers is one reason why the quest for food security has stalled.

**El Chile, Nicaragua**. Buried deep in the hilly municipality of San Ramon, the tiny village of El Chile clings precariously to the side of a steep slope. In the distance, extinct volancoes appear like pustules on the skin of the earth. Here patches of tropical forest remain, but most of the land has been cleared by subsistence farmers and their families. The one dirt road, which snakes its way through the hills, is washed out during the rainy season. When it is passable, only four wheel drive vehicles and horses can get through. But most people have to make the treacherous three-hour trek on foot.

Leopoldo Torrez, a subsistence farmer his whole life, has spent 20 years trying to scratch a living from a two hectare hardscrabble plot of rocky ground. His two crops of beans and maize are enough to feed the family for only six months, if he is lucky. Between harvests, during the "dead season", he seeks work as a day labourer doing whatever odd jobs he can find.

He has six children; three girls and three boys. All are in school, but during harvest time everyone helps out. His eldest daughter, Karla Maria, wants to finish high school and perhaps go on to college, but Leopoldo has no money for her education. "I am trying to arrange something with the church, but so far I can't find any extra funds to send Karla to college," he says matter of factly.

Life is sometimes unbearably hard for the entire family. "If the harvest fails, or I can't find enough work between harvests, we sometimes don't have enough food for everyone," he explains. "There is nothing worse than watching your children go to bed hungry."

"I wish, when I was younger, that I had access to family planning," confesses Leopoldo, "I would not have had as many children. Perhaps then I could have sent Karla to college."

The government has tried to help out farmers like Leopoldo, but so far development has eluded this remote corner of the country. He is fatalistic about the future. "Whatever happens, happens," he says flatly. "We have survived this far, we just have to keep going and hope for the best."

rice, wheat and maize – are the staple foods for four billion people, two-thirds of humanity.

Dependence on a few crops is downright dangerous: disease can spread rapidly through monocultures, as it did through the Irish potato harvest in the 1840s, killing a fifth of the country's population. FAO estimates that since 1900, about three-quarters of the genetic diversity of domestic agricultural crops has been lost. And the destruction continues.

According to the International Centre for Agricultural Research in Dry Areas (ICARDA) up to 60,000 plant species – roughly 25 per cent of the world's total – could be lost by the year 2025 if the current rate of plant genetic erosion is not halted. Tropical deforestation, rapid urbanisation, the destruction of vital wetlands and the cultivation of drylands has destroyed countless habitats for wild progenitors of domestic crops.

Dryland plant species are particularly hard hit. The world's genetic centre for wheat – the Middle East – has seen massive losses of natural habitat, areas that once sheltered valuable genetic reserves of wild wheat are now gone forever.

Without constant infusions of new genes from the wild, geneticists cannot continue to improve domestic crops. Cultivars need to be reinvigorated every 5-15 years in order to give them greater protection against diseases and insects. The most effective way to do this is to interbreed domestic varieties with wild ones.

One example shows just how vital this is. In 1970 virulent plague devastated one-sixth of the US maize crop, wiping out half the harvest in some southern states, at a cost of $2 billion. Plant breeders seeking a solution found two ancestors of modern maize in Mexico. Once developed, these two varieties of wild maize conveyed resistance to seven of the domestic crop's major diseases. Called the botanical find of the century, they might have been missed entirely. Only a few stalks of these ancient progenitors were found in an abandoned lot slated for development.

Continued genetic erosion of the wild relatives of domestic cultivars continues. The prognosis is not good, unless ways can be found to conserve areas of high biological diversity in their natural environment. Seed banks contain a growing *ex situ* collection of wild plant varieties. However, once collected and frozen in a gene bank they may be saved, but they cannot evolve further. Both types of seed banks need to be expanded.

## Food security

According to experts like Lester Brown of the Worldwatch Institute and Paul and Anne Ehrlich of Stanford University, there are three fundamental issues that need to be addressed before sustainable agricultural systems can be successfully introduced into many food deficit countries.

First, as a result of inequitable land use, mounting population pressures and migration, the capacity of farming communities in developing countries to produce food, manage land and protect the environment is being undermined. There is an urgent need – especially for the 82 food deficit countries identified by FAO – to slow population growth while at the same time promoting sustainable agriculture.

Second, despite adequate food supplies on a global level, food is neither produced nor consumed equitably. Market forces have not been able to meet global food needs, despite large surpluses in some countries and large deficits in others. In food deficit countries, the needs and potential of poor subsistence farmers, many of whom are women, are often overlooked or ignored. Within families, women and girl children often do not have equal access with men and boys to nourishing food. Without increasing access to food supplies for the most vulnerable, there is little prospect for long-term global food security.

Third, the main cause of malnutrition is poverty. Absolute poverty means poor diets and malnourishment. Although the percentage of hungry people has dropped over the past 20 years, their numbers have increased because of population growth. Today, an estimated two billion people suffer from micro-nutrient deficiencies in their diets and 840 million of them are chronically malnourished.

In order to accommodate the eight billion people expected by 2025, the world will have to double food production over current levels. This not only requires a different sort of green revolution, it also requires a "blue revolution" in terms of water conservation and sustainable use.

Ron Giling/Panos Pictures

**Left: Sustainable farming, Nepal**
**Above: Tomato fields, Egypt**
**Below: Planting trees along stone lines for soil conservation, Burkina Faso**

There have been some promising developments. The International Rice Research Institute in the Philippines announced that it has developed a super rice capable of boosting yields by 25 per cent, amounting to an extra 100 million metric tons a year. But if there is not enough water to irrigate this new strain, yields will not increase substantially, if at all.

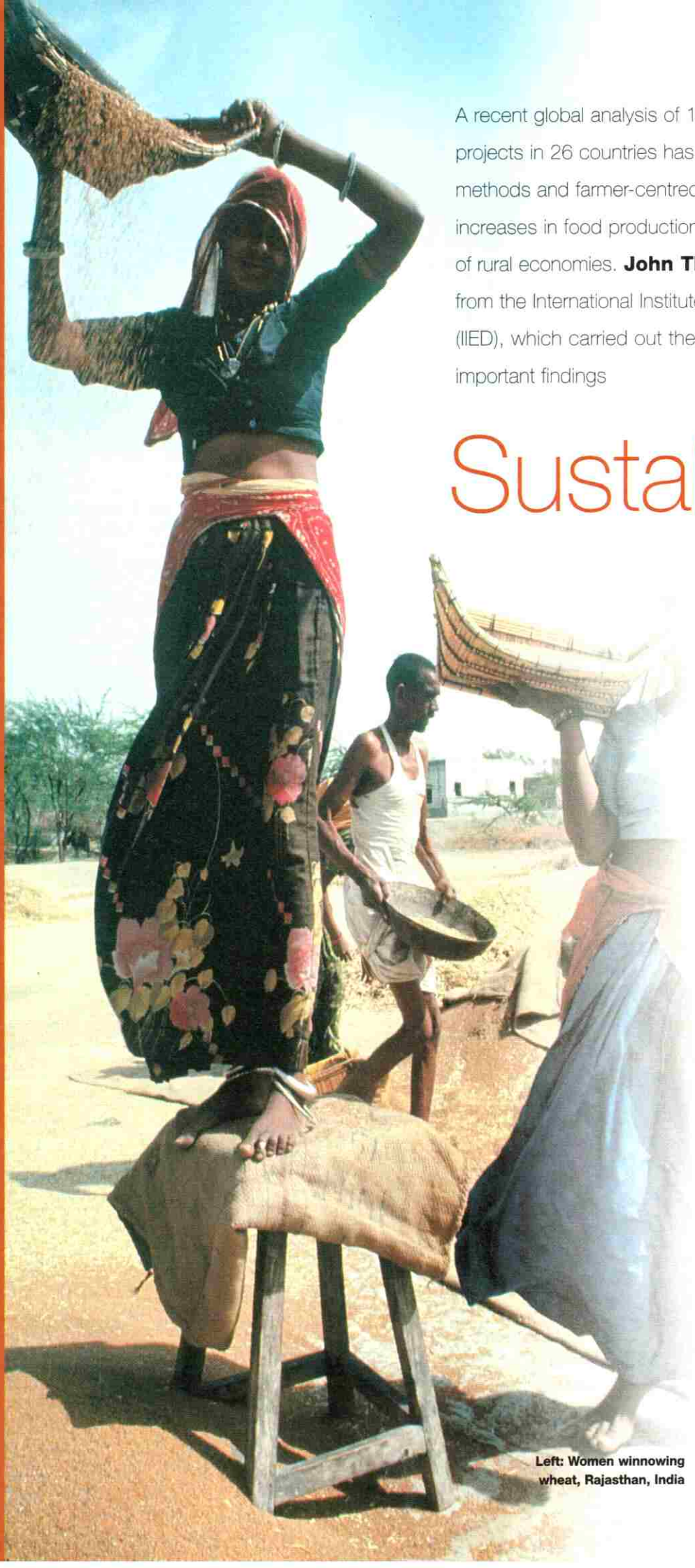
The bottom line is that food security cannot be achieved if two natural resources essential to agricultural production – land and water – continue to become increasingly degraded and polluted. Steps must be taken soon to reverse this course before irreversible damage is done to the world's finite resource base. How small farmers, and communities, can best be involved in this process is the subject of the reports that follow. ■

Don Hinrichsen is a Contributing Editor of *People & the Planet*.

Jeremy Hartley/Panos Pictures

A recent global analysis of 109 sustainable programmes and projects in 26 countries has shown that resource conserving methods and farmer-centred approaches can produce startling increases in food production and contribute to the regeneration of rural economies. **John Thompson** and **Fiona Hinchcliffe** from the International Institute of Environment and Development (IIED), which carried out the research, report here on its important findings

# Sustaining the



Left: Women winnowing wheat, Rajasthan, India

Mark Edwards/Still Pictures

As this century draws to a close, agricultural development faces some unprecedented challenges. By the year 2025, the world will have to support some 8.3 billion people. Even though enough food is produced in aggregate to feed everyone, some 800 million people still do not have access to sufficient food. This includes 180 million children who are underweight and suffering from malnutrition.

Recent approaches to agricultural development have largely failed to reduce the absolute numbers of the food insecure or to ensure environmental sustainability. While global achievements in food production have been impressive in the last 50 years, global inequalities in people's ability to acquire food, remains one of the biggest obstacles to achieving food security for all. Unfortunately, many policy-makers still fail to recognise that there is much more to creating food-secure livelihoods than simply producing more food, especially in the complex, diverse, risk-prone environments of the developing world.

That is where the more sustainable forms of agriculture have so much more to contribute.

## Making agriculture sustainable

Sustainable agricultural systems deliberately integrate and take advantage of naturally occurring beneficial interactions. They emphasise management over technology, and biological relationships and natural processes over chemically intensive methods. The objective of these systems is to enhance and manage complexity, rather than reduce and simplify the biophysical interactions on which agricultural production depends. This can be done by minimising the dependency on external inputs, such as fertilisers and pesticides, and by regenerating internal resources. This increases the likelihood that improvements will persist, as dependencies on external systems are

kept to a reasonable minimum.

But sustainable agriculture is also a lot more besides. A key emphasis is on the participation of farmers and rural people in all processes of problem solving. This ensures more equitable access to productive resources and better use of local knowledge, practices and resources. The ultimate outcome is an increase in self-reliance among farmers and rural organisations.

Adopting sustainable agriculture does not mean a return to some form of low-technology, 'backward' or 'traditional' agriculture. Instead it pursues a blend of innovations that may originate with scientists, with farmers or both.

# harvest

But precise and absolute definitions of sustainability are impossible. One of the central aims of sustainable agriculture is that the approach should be flexible, and not prescribe a pre-defined set of technologies, practices or policies. This would only serve to restrict the future options of farmers. As conditions change and as knowledge changes, so too must farmers and farming communities. Sustainable agriculture is, therefore, not a simple model or package to be imposed. It is more a process of learning and adaptation.

## Making most of the least

The sustainable production of food is the first pillar of food-secure livelihoods. To achieve this, a farming system must not only be able to produce enough food to feed a household, but it must also achieve this within often rapidly-changing and unpredictable local environmental, economic and social conditions.

Evidence from around the world is growing to support the view that adopting sustainable agriculture can bring substantial yield improvements to farmers, especially in very diverse and ecologically fragile areas. Located in the arid and semi-arid lands, wetlands, uplands, mountains and hillslopes of developing countries, these peoples must rely on internal resources such as rainfall, biologically fixed nitrogen, nutrients from lower soil strata and biological pest control based on natural enemies.

They are often remote from public services access roads and telecommunications, and they commonly produce one-fifth to one-tenth as much food per hectare as farms in the more richly-endowed Green Revolution areas.

Apart from those examples in Honduras, Zimbabwe and India described elsewhere in this issue, there are many other cases of food deficit areas such as parts of Ethiopia, Kenya, Uganda, and Burkina Faso becoming food surplus areas following adoption of sustainable agricultural practices. As yields increase, farmers feel secure enough to diversify into new crops.

In Honduras, for example, farmers who used to grow maize exclusively now cultivate upwards of 25 crops per farm. In Gujarat, India, farmers have moved away from sorghum/millet-based systems to grow many types of vegetables. In Taita-Taveta, Kenya, a local NGO reintroduced traditional staples of sweet potato, arrowroot, sugar cane and bananas, together with fruit trees and zero-grazing for livestock, leading to a reduction in food insecurity and an improvement in the nutritional status of the local population.

## Beyond the farmgate

Despite the virtues of many resource–enhancing production systems, it is evident that sustainable agriculture alone will not be sufficient to meet the broad food security requirements of growing numbers of poor rural dwellers. As most of the forces creating poverty are economic, political and social, rather than strictly agronomic or ecological, they reflect systems of resource allocation that can be adjusted, improved or reversed. Pricing policies, credit systems, marketing systems, and social and productive services that neglect the poor, as well as gender discrimination, are not natural, universal or inevitable facts – and neither is the poverty to which they give rise.

For a host of reasons, not all rural people are able to produce their own food, and in many areas and for many people, agriculture is not the only, or even the main, source of income. In some areas, increasing population pressures have led to the complete absence of free land for development.

An important lesson drawn from the recent evidence of sustainable agriculture is that it needs to be placed in a wider context. Strengthening other employment sources, such as small-scale enterprises, cottage industries and small-scale processing units, in rural areas can help take pressure off land. This can then mitigate degradation – although this also depends on many other factors, such as land husbandry practices, access to markets, security of tenure. Furthermore, if much of rural consumption depends on non-agrarian incomes and entitlements, then to concentrate exclusively on resource-conserving technologies and practices and farmer-led research and extension will address only part of the problem.

In short, 'success' comes in many forms. It cannot be measured solely on the basis of the number of community tree nurseries, multiple cropping systems, grass strips or bench terraces that spring up across the landscape. Hence, we must make certain that agricultural and rural policies do more than simply focus on improving productivity, while the unnoticed nutritional status of the families involved becomes yet more chronic as a consequence of other changes in the regional economy.

Finding the institutional mechanisms to make this work will be very difficult, but not necessarily impossible. Identifying and supporting these institutional arrangements, and helping develop the markets for the products being processed should be a central thrust of any broad sustainable agriculture policy. ■

This article draws on the findings of two recent research projects carried out by IIED's Sustainable Agriculture and Rural Livelihoods Programme. The first project was based on 23 detailed case studies of the economic, environmental and social impacts of participatory watershed management and soil and water conservation programmes in Africa, Asia, Australia and Latin America. The second study involved a review of experiences with sustainable agriculture and food security in 86 projects in 14 countries in East and Southern Africa. Both projects were supported by the Swedish International Development Co-operation Agency (Sida) among others.

### A 10-point plan for policy change

**1**. Establish national policies and strategies that support sustainable agriculture, such as redirecting subsidies and grants towards sustainable practices.

**2**. Reform agricultural teaching establishments to encourage the formal adoption of participatory approaches.

**3**. Develop farmer-centred research and extension by supporting farmer-to-farmer exchanges and schemes for farmer training in their own communities.

**4**. Create policies which encourage the retention of economic surpluses in rural areas gained from the production and marketing of agricultural products.

**5**. Enhance non-agricultural incomes and off-farm employment in rural areas.

**6**. Decentralise and devolve authority from governments and aid agencies, while developing the capacity of local organisations to demand the resources and services they need.

**7**. Support rural women as producers and innovators by increasing their access to productive resources (such as genetic material), savings and credit, agricultural information and formal education and training.

**8**. Secure property rights for peasant producers, especially through communal tenure systems, by protecting local access to and control of land and other productive resources.

**9**. Form or strengthen farmers' organisations to encourage persistent co-operative action in agricultural production and resource management.

**10**. Increase local access to capital for investment in agriculture and resource management by avoiding land-tied credit and supporting establishment of local savings and credit schemes.

# Mimicking nature t

The poor red baked soils common in the hilly peasant farms of Central Honduras, are becoming dark, rich producing ones through new organic farming methods. **Charlie Pye-Smith** travelled through the region to research this first in our series of investigative reports into the seeds of hope,

"I used to farm these fields using traditional methods," explains Francisco Cerratos. "I grew corn mostly, but the soil was so poor I hardly produced anything." Then in 1992 an organisation called COSECHA (the Association of Consultants for a Sustainable, Ecological and People-Centred Agriculture) visited the hilly country to the east of Guaimaca, in Central Honduras, with news that even these hostile tropical soils could be made productive. "They suggested I grow beans as well as corn," recalls Francisco. "People round here said it wouldn't work, but in reality we'd never tried."

Four years ago Francisco sowed 5lbs of beans and harvested 100lbs. Since then his yields have tripled and the methods introduced by COSECHA – contour planting, mulching, minimum tillage – have transformed him, in his own words, from peasant to producer. "My life has changed," he says simply. "Now we have enough money to buy the food and clothes we need." With a pistol poking from trouser pocket, and hat tipped cockily to one side, Francisco exudes confidence.

None of this surprises Eduardo Tomas, the Guatemalan Indian who taught Francisco new ways of farming. For the past 20 years – first as an extension worker for the American non-governmental organisation World Neighbours, now as co-ordinator for COSECHA – Eduardo has been weaning farmers off crops and methods of cultivation which destroy soils and introducing them to techniques which restore fertility.

"Chemically, I can't tell you how this soil has changed," he says, stooping to feel the earth in Francisco's bean field, "but I can see the difference. Before it was red and baked. Now it is black and rich in organic matter."

Francisco used to plant crops in rows across the slope of his fields. Now, using a simple device known as an A-frame, he plants along the contours. He also sows a green manure crop, velvetbean, alongside the food crops, and he practices minimum tillage: the less the soil is disturbed, the less erosion there will be.

In nearby San Jose, Pedro Matute is one of 37 farmers – out of 56 – who have taken Eduardo's advice, and his bean yields have quadrupled in the past four years. "At first," says Pedro, "many farmers round here were suspicious. When they saw me planting along the contours they scoffed. But I carried on. I didn't listen." However, Pedro knew he was onto a good thing, having witnessed World Neighbours' endeavours in the Cantarranas region. Here, and in three other areas in Central America, its farmer-to-farmer extension programmes have had a profound impact on rural communities. Their success lies not so much in what was achieved during the years when the organisation was active, but in what has happened since it left: yields have continued to rise as farmers have adapted and improved the technologies introduced by World Neighbours.

Roland Bunch, the director of COSECHA, was a key player in World Neighbours' various programmes in Honduras and Guatemala in the 1980s. "Most farmers simply don't believe that soil can be improved while they're farming it," says Bunch from his office in Valle de Angeles. "And most western scientists seem to think the same. They claim you can only build up topsoil at the rate of an inch

Charlie Pye-Smith

Charlie Pye-Smith

**Right: By adopting World Neighbours and COSECHA pioneering techniques, overgrazed pasture has become highly productive cropland**

# o grow more

a century. But here we have indications that we are increasing topsoil by a third of an inch a year."

It took Bunch some time to work out precisely how he and the farmers were doing this. "What we now realise," he says, "is that if you are going to use these soils, you have to do what moist tropical forests do. You have to mimic nature and get nutrients from the mulch, from the litter layer." Planting along the contours counteracts the gravitational movement of water, slows down soil erosion and leads to the natural formation of small terraces. The use of green manure helps to protect the soil from the sun and slow down evaporation. Just as significantly, the manure and the mulches – rather than the soil – provide nutrients for the food crops.

Since Bunch and his Guatemalan colleagues left World Neighbours in 1992 – the latter had decided to dispense with non-Honduran staff – they have continued to promote what is cumbersomely termed participatory technology development. This involves farmers and agronomists working together to find the technologies which help improve soils and raise yields. Bunch stresses that what matters is not that the technologies are sustainable – often they are not – but that farmers become involved in a process of innovation which is sustainable.

Development agencies frequently pronounce their projects to be successful, forgetting that true success can only be measured long after their departure. All too often agricultural projects collapse once the agencies withdraw. Referring to a recent analysis of farm practices in three areas where World Neighbours were active in the 1980s and early 1990s, Bunch says: "We now have scientific proof that farmers have carried on the process of development and further increased their yields since we left."

In 1987, when World Neighbours arrived in Guacamayas, none of the farmers rotated their crops. When they left in 1993, 36 did; now 58 do. In the village of Xesuj in Guatemala, none of the farmers used green manure when World Neighbours arrived in 1972. By the time it left seven years later, 20 farmers were using green manure; now 36 are.

Irma Guttierrez's plot of steep land in Guacamayas, an hour's drive from COSECHA's

### 2020 Challenge

Latin America, like other developing regions, faces the triple challenge over the next 25 years of feeding a growing population while reducing poverty and protecting nature.

Of the 2.5 billion additions to the planet's human population by the year 2020, about 200 million will be in Latin America: not a huge share of the additional numbers, but a real challenge to the farming sector.

Latin America's relatively poor agricultural performance is at the heart of the region's increasing poverty and rapidly deteriorating natural resource base. Between 1979 and 1990 food output grew just enough to keep per capita production level. Since then household food security has continued to deteriorate in 8 of the 21 countries in the latest UN assessment.

The number living in poverty increased from 195 to 250 million over the 1980-92 period – most of them in the towns and cities. Meanwhile, more than 2 million hectares suffered from moderate to severe erosion.

*(Adapted from the International Food Policy Research Institute 2020 Brief No.45, By Eduardo J. Trigo.)*

**Francisco Cerratos on his farm in the hilly countryside east of Guaimaca**

Charlie Pye-Smith

**Left: Pedro Matute in his bean fields**

office, looks like a model farm, yet the transformation from arid pasture to productive cropland has largely taken place since World Neighbours left. Above the house where her brother lives – he looks after the land while Irma works for COSECHA – are coffee and fruit trees; below there is a mix of soft fruit and vegetables. Scarcely an inch of soil is visible. Green manures and a mulch of crop residues form a dense mat around taller crops like maize, and the terraces are rimmed with 'live barriers'. The barriers help to slow down the movement of soil and water, and by trapping soil they actually encourage terrace formation. In Guacamayas, and in the Guinope region in South Honduras, the changing nature of the live barriers provides a compelling illustration of farmers improving an introduced technology.

When World Neighbours moved into Guinope in 1981, farmers were encouraged to plant king grass and napier grass along the contours. According to John Hellin, a researcher from the British Natural Resources Institute now based in Honduras, these two grasses proved far from ideal. "They are very good at retaining the soil," he explains as he tramps along a luxuriant barrier, "but they are very invasive. They suffocate other plants and leach nutrients away from the food crops. They may be good fodder crops, but in Guinope farmers have little livestock."

As a result many farmers have pulled out the grasses, but they have not abandoned the technology. Lucio Nunez, for example, has replaced the grasses with coffee, plantains, sugar cane, peaches and other perennial food crops. "What Lucio and many other farmers want," says Hellin, "is a barrier which helps retain the soil and at the same time provides them with food."

As an outsider, Hellin is well placed to judge the achievements of World Neighbours, and he highlights two factors which have contributed to its success in Guinope. First, World Neighbours recognised that farmers wanted to see tangible benefits as quickly as possible, so it encouraged them to use chicken manure as a fertilizer. Yields rocketed; the farmers were impressed. Second, World Neighbours understood that the new technologies were a means to an end, not an end in themselves. It encouraged farmers to be innovative, and the transformation of the live barriers is testimony that they have been. In one village alone, 16 innovations have been adopted since the programme finished in 1989.

Nowadays farmers in Guinope seldom refer to World Neighbours. Rather, they talk of los Guatemaltecos, referring to the Guatemalan extension officers who passed their knowledge on to the local farmers, some of whom were trained as village extension workers themselves. The latter received a three-year training and most were unpaid. "They did the job for the honour and self-esteem it brought," reflects Hellin approvingly, "not for material gain."

Bunch has come up with four key factors which contributed to the success of the World Neighbours programmes, and which should guide organisations working with farmers. The 'farmer first' approach, using village extension workers and participatory technology development, is of fundamental importance. There should be rapid, identifiable gains for the farmers. The process should be initiated using a small number of technologies. Finally, farmers should be encouraged to avoid all forms of dependency and be capable of taking over programmes when development agencies leave. ■

Charlie Pye-Smith writes about development issues and is currently working with the International Institute for Environment and Development (IIED).

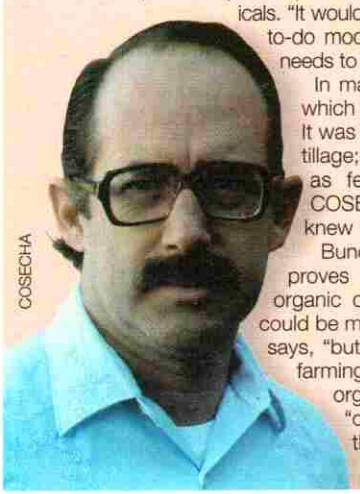
### LEARNING FROM A LIFETIME OF EXPERIENCE

For the past 30 years Roland Bunch has been tramping through the bean fields of Central America. His down-to-earth experiences with peasant farmers and his championing of 'people-centred development' were lucidly expressed in his celebrated work, *Two Ears of Corn*, which since its publication in 1982 has been translated into Gujarati, Vietnamese, Indonesian and many other languages.

Bunch is disturbed by the fads in agricultural development. "We are forever hearing that such and such a crop or technology is the answer," he says wearily. "And for a while there will be a boom, soon to be followed by a bust." A while ago people saw the winged bean as the salvation of poor farmer; then it was the miracle tree, Leucaena. At present it is vetiver grass, much-loved as a live barrier by the World Bank; at other times it was strawberries or mushrooms. Occasionally there is a boom which lasts. "The participation boom has worked out," says Bunch, but he swiftly adds that many organisations have been too starry-eyed about the ability of village farmers to provide all the solutions to their problems.

"The dominant theory now is that we should ask villagers what their problems are and how to solve them – then help them do it," says Bunch. "My feeling is that if villagers already know the solutions to their problems, why are they so dumb they haven't applied them?"

Bunch points out that poor people, left to their own devices, will often mimic the rich. In Honduras, for example, the poor often want to get hold of tractors, rear cattle and use chemicals. "It would be a tragedy if we went back to the we'll-tell-you-what-to-do mode of development," says Bunch, "but I do think there needs to be a partnership between agronomists and villagers."



COSECHA

In many instances villagers are not aware of technologies which can help them. Experience in Honduras bears this out. It was the Brazilians who first discovered the benefits of zero tillage; the Costa Ricans who realised mulches could be used as fertilizer. Organisations like World Neighbours and COSECHA have put farmers in touch with technologies they knew nothing about.

Bunch believes that work in Honduras and Guatemala proves that farmers can get very high yields using almost organic or low input systems. "I suspect organic agriculture could be more profitable than high input chemical agriculture," he says, "but nearly all the agricultural research goes on chemical farming." And what if there was a switch to research into organic farming? "Then in 15 to 20 years," replies Bunch, "organic farming would blow high input agriculture out of the ocean."

# Lighting a dark corner

**Ray Choto** reports on a women's garden club in Zimbabwe.

Heine Pedersen/Still Pictures

As the dust from the desiccated rural road curls into the sky, a group of women farmers cuddling their babies raise their heads, peering in the direction of the approaching vehicle and when a white Toyota twin-cabin truck stops a few metres from them, there are smiles all over the faces of the Chivi peasants, inhabitants of the Karanga community, situated some 410 km south of Zimbabwe's capital, Harare.

"Every time we see this car coming here, we welcome it with an air of hope. In fact, we perceive it as a symbol of unity, self-reliance and above all, our messiah," explains 32-year-old Mrs Sarudzai Muteuri.

Muteuri is a member of Rodonevhu vegetable garden club in Chivi's Ward 21, one of the two wards in Magwiro village in Masvingo province that have benefited from the Intemediate Technology Development Group's (ITDG) farming project aimed at improving household food security.

"When ITDG came here, they encouraged us to work together to ease labour on land tilling. Work together has brought us closer to each other. We now have mutual respect for each other. Over the years, crop production has increased due to group work and improved farming methods. But before the project, our village was one of the poorest areas which people used to refer to as Chemira (The Dark Corner)," says Muteuri. She says her ward's success story to achieve food security is one which cannot be told without mentioning ITDG.

"It encouraged us to embark on vegetable garden clubs after harvesting crops, thus keeping ourselves busy throughout the year. Today, we have 35 productive garden clubs in our ward and we sell our vegetables to needy communities," she says.

ITDG's rural communities programme manager, Kudakwashe Murwira, says the objectives of the Chivi project were, among other things, to enhance household food security through improved agricultural production and a process of participatory technology development, building upon local farming skills and experiences.

When the programme started in 1991, Chivi farmers were less organised than they are today, although there were farmers' clubs, mainly dominated by men, and the district was facing a devastating drought. In 1992, one of the worst droughts on record took hold in Zimbabwe leaving many families unable to feed themselves. Over 770,000 people in Masvingo province relied on drought relief. The province received only 28 per cent of its normal rainfall. Gardening projects were abandoned and 90 per cent of arable land had dead crops. More than 30,000 cattle died, leaving most families without draught power.

*'Every time we see this car coming, we welcome it with an air of hope'*

Like millions of other drought stricken Zimbabweans, Mrs Muteuri had to register for food aid to feed her family of three children. But today she is self-reliant, thanks to the ITDG project which has helped her community to identify strategies that enhance food security.

Before the project, state extension workers had a top-down approach which generally failed to consider whether suggested farming methods fitted the needs of local farmers. Farmers, in turn, tended to wait for external help to change their lives and this eroded their traditional knowledge of land management.

ITDG staff had to change this orientation among all concerned. They came up with a bottom-up approach which, in the following years, proved to be more successful.

The project re-introduced intercropping and integrated farming systems since most households have very little land. In Chivi, with a population of 200,000, the average household of six people has only about one hectare of land, and numbers are increasing nationally by three per cent a year.

The indigenous concept of intercropping onions and other vegetables is also being tried in vegetable gardens as a way of managing pests, which are discouraged by the scent of onions, hence reducing chemical inputs. Vegetable gardens are proving a valuable contribution to household food security. The vegetables, fertilised with chicken and goat manure, are highly nutritious and a valuable source of Vitamin A.

During the 1997 crop season, Muteuri harvested 4,500 kg of shelled maize, 600 kg of sunflowers, 900 kg of millet and 500 kg of sorghum – enough food to see her family through to the next harvest while the surplus will be sold. Being able to feed her family and sell the surplus means food dependence-syndrome that used to characterise the people of Chivi is now a thing of the past.

Improved organic farming practices in Chivi and other rural areas have a bearing on the 1997 crop season in which Zimbabwe harvested 2.19 million tonnes of maize, a 16 per cent drop from the 1996 output of 2.6 million tonnes. However, agriculturalists say the fall in production reflects the adverse effects of excessive rains which saw over 80 per cent of the country receiving above normal rainfall, with much flooding and water-logging.

Chivi itself, remains a drought-prone area and ITDG has assisted the community with water conservation techniques through harnessing run-off water into contour ridges that have infiltration pits. "Through force of gravity, water in the infiltration pits moves downslope and continues to moisturise the soil and sustain the growth of crops once the rains have gone," explains Zephania Chadyiwa, another farmer in the project area. He says the technology is paying dividends through increased crop yields. ■

Ray Choto is *People & the Planet* correspondent based in Zimbabwe.

**Above: Working in a vegetable garden, Zimbabwe**

**Bishakha Datta** reports on an Indian success story.

# Turning dusty land into a flowering orchard

A sickle. A shovel. A steel plate. A schoolbag. A waterpot. A couple of coins. And a handful of paddy. All carefully lined up in the middle of a south Indian village. What on earth does it mean?

This spontaneous sculpture – put together by the villagers of Meenakshipuram in the southern state of Tamil Nadu – is the outcome of a community mapping exercise held on a sultry August evening in the village square. Using participatory rural appraisal techniques, the exercise aims to understand the benefits of a water conservation scheme that was initiated in the village two years backed by a local non-government organisation.

The sickle indicates a good harvest, while the shovel points to greater employment that the scheme has generated, that too in the dry white season when the soil is parched and the land is just a leap of the imagination. About 45 extra work days were created last year, the villagers say, which leads to the steel plate, an unlikely symbol of migration.

Each year, the men of Meenakshipuram travel to the neighbouring state of Kerala in search of work when the rains end; they migrate to fill their stomachs, hence the steel plate. Last year, they didn't have to go away for the first time in two decades, since they had enough work on the water conservation scheme. The villagers also got higher quality crops this year, symbolised by a handful of paddy, and made more money – spent on buying household goods ("the waterpot") and school expenses ("the schoolbag"). "If we hadn't had this money," explains a garrulous old man, "we would have taken a loan from the moneylender at 5 per cent interest each month. Our lives have really changed."

*'Although women are the real bread-winners they are not recognised as human'*

## Hidden tanks

Behind this outpouring of public goodwill is a complex process that was started in this drought-prone district almost a decade ago with the formation of SPEECH (Society for People's Education and Economic Change). Kamaraj, the district where SPEECH works, is Tamil Nadu's dryest district, so dry that conventional notions of landlessness have little meaning here. Even a farmer who owns 200 acres of land, is in some sense landless, since land without water will not produce anything.

When Kamaraj, after whom the district is named, was chief minister, he planted clumps of prosophis, an imported quick-growing weed all over the area. The weed was used to make charcoal and generate incomes in a district with few employment opportunities. Today, hordes of green prosophis bushes have greedily taken over the landscape and completely robbed the soil of whatever little fertility it once had – a classic illustration of the fundamental paradox that sustainable development tries to address.

SPEECH firmly believes that natural resources cannot be conserved nor development be sustained unless people and communities themselves are involved. "The responsibility of the people has been eroded, since the government has taken responsibility to maintain natural resources," explains Rajan, who manages SPEECH's field programme. "We need to rebuild the people's sense of ownership and responsibility."

SPEECH attempts to rebuild this sense by forming and strengthening local community groups – from 1993, the focus has shifted from organising the community to organising women. "Although women are the real bread-winners," explains women's organiser Parvati, "they are not recognised as human. They are not economically independent. They have no access or control over natural resources."

In Meenakshipuram, 33 women are members of the sangha or group formed four years back. The project started off here almost five years ago with non-formal education classes, where women came together not just to chant "A for Apple, B for Ball" but to actually discuss common problems. Why are there no streetlights in the village? Why is there no drinking water? How can rainwater be harnessed?

Sangha discussions, supplemented with PRA mapping exercises, gradually revealed the presence of a 50-year-old tank system in the village itself. The tank hadn't been maintained by the government, since it had never been categorised – either as a union tank or a Public Works Department tank.

Using an approach that had succeeded in other villages, SPEECH motivated

the villagers to refurbish the tank system. Responsibilities were divided: villagers had to clear the land, running wild with prosophis, build bunds and pits. SPEECH took the onus of ploughing the land, and got the government to test the soil and build a percolation tank to recharge groundwater resources. The women's sangha supervised the entire process, negotiating free labour for some tasks, fixing equal wages for others, and deciding that each family must contribute half a bag of paddy for maintaining the tank system.

If this process has empowered women to take control of a vital natural resource, it has also provided a lifeline for the community. The tank system, which now waters 20 acres, will ultimately irrigate 70 acres, benefiting 32 of the 33 sangha members who own land here. "The landless also get employment in desilting and excavation activities," explains Rajan. "When the barren land becomes productive, they will be employed as farm labour. So they will also benefit."

The benefits are already visible among sangha members, many of whom are descendants of Thevars, or ancient soldiers. "Previously we would sit at home, cook our food, eat, not bother about anything else," says sangha treasurer S. Ponirul, whose pierced, bejewelled earlobes stretch almost to her shoulders. "Now, once a month, we come together with one mind. We don't just worry about ourselves but also about our village."

### Poor man's bank

Ponirul talks about another benefit of the sangha formation process – economic freedom. The sangha has started a scheme for providing low-interest credit to members, who are also eligible for loans to start small household-level businesses. Rearing goats seems to be the most popular home enterprise, with each woman rearing 12-15 goats. "The goat is like a poor man's bank," explains Ponirul. "In an emergency, we can sell one small goat and meet our needs."

Almost 142 women have been given loans to rear goats, which are traditionally seen as damaging to the environment. SPEECH believes otherwise; goats prune the land, loosen the soil and allow rainwater to seep inside. Similar schemes run by the government have been ineffective, since women were forced to take on 'government-approved' occupations such as pickle-making, which they knew nothing about. "But we build on what people already know," explains programme director Erskine Arunothayam.

This core value – building from the community – governs all the organisation's work. In Meenakshipuram, drinking water is still a gigantic problem, since groundwater is alkaline. Drinking water is piped in by the government to eight villages – but the pipe is often punctured en route. SPEECH's solution is to help the people work out their own solution. All the sanghas in these villages have been connected into a federation – called the Cluster-Level Governing Council, which takes up issues that cannot be solved at the village level.

Collaboration, rather than confrontation, is typically used to deal with thorny issues – such as caste. Caste is a key factor determining access to natural resources such as land and water; India is littered with a million instances of upper-castes refusing to let lower castes draw water from community wells. Such volatile issues are tackled through village-level negotiations conducted by the women's sanghas; in villages like Ruchipuram, access to water has been provided to dalit (scheduled caste) communities. The organisation attempts to broaden access "without broadening the gap between dalits and other groups," explains Rajan.

But when it's necessary to play hardball, SPEECH doesn't balk. Four years back, the villagers of Othaveedu realised that a new 'cotton factory' actually manufactured potassium chloride. Almost 300 adults and 50 children were affected by the toxic effluents from the factory, water in the village wells turned yellow, and 50 families were made effectively landless when their crops failed. A series of representations by the sangha and the Cluster-Level Governing Council resulted in the factory's closure. After this, 24 polluting factories have been shut down in the district. "Nobody should sell land to outsiders," says Erskine. "Resources should remain in the community."

Jules Pretty

**Above: Tank to conserve water**
**Below: Watershed improvements transform the land**

Easier said than done. But ten years since it started, SPEECH is turning dry soil into flowering orchards. A farmer in Paraikulam hands us a bouquet of guavas and groundnuts; the village has moved from producing one crop to three crops each year and the neighbouring village is clamouring for the same conservation scheme. Here and there, a few farmers have shifted from using chemical fertilisers to organic pesticides and vermicompost; the organisation encourages farmers to sow telrosia, a nitrogen-fixing legume, in their backyards. Small beginnings perhaps, but vital steps on the ladder of sustainable agriculture, or in SPEECH's vision, agriculture that is chemical free, environment friendly, socially just, and economically feasible. ■

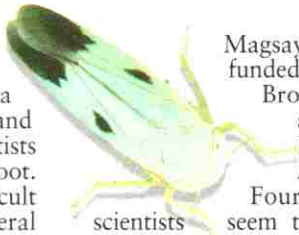
Bishakha Datta is *People & the Planet* correspondent in India.

Jules Pretty

A five-year programme in the Philippines, to reduce over-reliance on chemical pesticides and free farmers to find more natural methods of pest control, is now being evaluated. **Linda Bolido** reports on one successful project.

# Helping farmers fight pests

Linda Bolido



Nigel Cattlin/Holt Studios International

On 1993, when scientists from the University of the Philippines College of Agriculture (UPCA) went to Infanta in Quezon province, the town – although just southeast of the main Philippine island of Luzon and some 400 kilometres from Manila, the national capital – was almost inaccessible.

Linda Bolido

Roads leading to the picturesque town sandwiched by the Pacific Ocean and the rugged Sierra Madre mountain range were bad and many of the places that the scientists had to visit can only be reached on foot.

If going to Infanta was difficult enough, the other town – General Nakar – was worse. A former *barangay* (village) of Infanta, the town was accessible from the latter only by traversing a river which gets dangerously swollen during the wet months. Even now, General Nakar's main road is unpaved and is just a little wider than a dirt road.

The UPCA scientists, led by Dr Jose Medina of the Department of Entomology and National Crop Protection Centre, went to Infanta and General Nakar to spread the gospel of sustainable development, specifically integrated pest management (IPM).

IPM refers to the control of biological plant diseases and destructive insects by using a combination of botanical, biological and cultural methods and limited amounts of chemicals. IPM practitioners use a combination of disease and pest-resistant varieties, natural predators of harmful insects and indigenous plants to keep their crops healthy and high-yielding. Philippine President Fidel Ramos describes IPM as "letting nature take care of...harmful insects."

The Infanta and General Nakar farmers reported reducing their use of pesticides by 30 to 50 per cent after almost four years of practising IPM. One farmer, with more sizeable land, even reported a more dramatic drop – from 75 to 15 sacks in one planting season.

The project, Technology Application for Sustainable Agriculture: The Farmer-Scientist Approach, was supported by the Programme for Asian Projects, a grant programme for Asia's Ramon Magsaysay Award winners funded by the Rockefeller Brothers Fund and administered by the Ramon Magsaysay Award Foundation.

Four years later, the scientists seem to have learned as much as they have taught their farmer-participants.

Benigno Candia of Infanta, 69, a fisherman turned farmer, said when he started growing rice he simply followed what others were doing. He was not even thinking about how far apart his seedlings should be from each other. But since learning about IPM he has been able to differentiate between friendly and unfriendly bugs, analyse the soil and make compost. He has saved on seedlings as he plants only one per hole instead of three or four before. Moreover, he said, Dr Medina encourages them to develop their own varieties and become farmer-breeders.

When Banelene Sollestre joined Dr Medina's class in Infanta, the group suspected her of being a military intelligence officer. The mountains of Quezon province still shelter some communist insurgents and the military was known to keep a watchful eye on activities involving peasants. The suspicion about the young woman seemed justified as she was not even a farmer at the time, as her land was being cared for by a tenant.

Following her training, Banelene has since drawn from her grandmother's knowledge about pest control in managing her farm's problems. Among grandma's advice is to provide food such as grated coconut or rice husks for the snails. When they come out to feed, the paddy can be filled with water to wash the snails away (or they can be collected and destroyed).

Banelene said when she took over her farm, the soil had become quite sticky and difficult to till. Today, the soil is healthier and her rice plants appear greener every year as she lessens use of agricultural chemicals.

Tranquilino Nakar, 62, nephew of General Nakar, a World War II hero after whom the town is named, is pleased that the things he used to do to

protect his crop when he started farming at age 15 are now becoming acceptable again. He recalled that they did not use any synthetic fertiliser when he was young. As for pests, they are now again using such plants as tagbak (*Kolowratia elegans*), makabuhay (*Tinospora sp.*) and nami (*Dioscorea sp.*).

Lamberto Bustonera, also of Gen. Nakar town, has come up with pest sprays mixing water, kerosene and common plants like chilli which are known to cause irritation. At the same time, he also encourages the proliferation of spiders, wasps, dragonflies and other insects which he now knows to be helpful in controlling pests. He noted that before, the colour of his rice changed every planting season and his soil became increasingly rubbery. But now his grass is greener as he uses less chemical fertiliser.

Jaime Cortales said initially they were being laughed at by their colleagues as they reduced their use of agricultural chemicals. But now they are showing a keen interest as his cost of production dropped significantly by using fewer seedlings, and less chemical spray and other agricultural chemicals. The soil in his paddy has also become healthier. His wife, Ligaya, has another reason to welcome IPM. She said rice grown with less chemicals tastes sweeter.

Farmers in both Infanta and General Nakar have since learned that a piece of cloth dipped in a mixture of chilli or some other irritating plants, positioned so that a rodent is sure to get in contact with it as it leaves its hiding place, causes so much distress and discomfort that the animal bites itself to death.

They are now making their own compost, saving most of the farm wastes for this purpose. Some of the farmers have ducks not only for extra income but also to take care of the snails especially when they are still small.

Teodoro Panida, vice president of the Samahan ng mga Likas-Kayang Magsasaka ng Infanta (SALIKAMI or roughly Association of Sustainable Agriculture Practitioners of Infanta), is taking steps to become a farmer-breeder. With his paddies occasionally devastated by floods because of poor drainage, the retired military man is propagating in a small portion of his farm a seedling from his own crop which was able to withstand the rising waters.

Panida, who was part of a Philippine military contingent to Vietnam in the 1960s, said, since he started to practise IPM, his one hectare now yields 82-86 sacks of rice whereas before, when he was heavily dependent on chemicals, he could not even get 80 sacks, the government's target yield per hectare. As production cost has significantly dropped because of fewer inputs, his increased yield has meant bigger profits.

Dr Medina says that while before, a farmer spent P5,000-8,000 (US$150-250) during the planting phase of a cropping season, IPM and other practices associated with sustainable agriculture have since reduced this to P2,500 (US$80).

But he maintains that the Philippine IPM programme's more significant accomplishment is in encouraging greater creativity and initiative among the farmers. The farmers have gone beyond the basics the academics have taught them. Drawing from tradition, personal experience and peer advice they are developing solutions to their farm's specific problems – some shared with others but occasionally unique.

Dr Medina said the farmers have honed their skills in analysis and decision-making, skills which they are using outside their farms such as in the associations they have formed with their peers and their relationship with the government.

Dr Jesus Binamira, co-ordinator of the Department of Agriculture's national IPM programme, said the country's campaign is basically aimed at enhancing the farmers' skills for making more informed decisions about their farms and their problems. "Telling them (farmers) not to use pesticides is just as bad as telling them to use the chemicals," he said.

Dr Binamira said the bottom line in IPM is the growing of a healthy crop. The national programme wants to achieve that goal by giving farmers options, empowering them to choose the solutions to their own problems.

The official said empowerment would be a more crucial measure of how well the Philippines' IPM programme has done.

The government launched a series of farmers' field schools (FFS) to popularise IPM at about the same time the University was starting its project in Quezon. As one such school in an upland barangay in Bacong, Negros Oriental in central Philippines, showed, farmer-trainees are first taught to identify and analyse the problems in their respective farms such as the existing pests. Later in the 14-16 week course they are provided options for solving the problems.

The participants in this particular FFS, ranging in age from 18 to 69 years, although farmers of long standing, knew little about bugs and worms except that they were realities of farming. For most of the farmers, it was the first time to hear that there could be an alternative to chemicals.

Nenita Calumpong, IPM facilitator, said in some Negros villages, chemical use was so severe that the farmers themselves did not even want to eat their own produce. According to the provincial agriculturist and IPM co-ordinator, chemicals accounted for 33 per cent of the cost of production of vegetable farmers.

The Philippines' five-year national IPM programme is known as Kasakalikasan, the acronym for Kasaganaan sa Sakahan at Kalikasan which the Department says means "nature is agriculture's bounty". It evolved from small projects launched after the UN Food and Agriculture Organisation (FAO) arranged for a group of Filipinos to observe the implementation of IPM in Indonesia in the early 1980s.

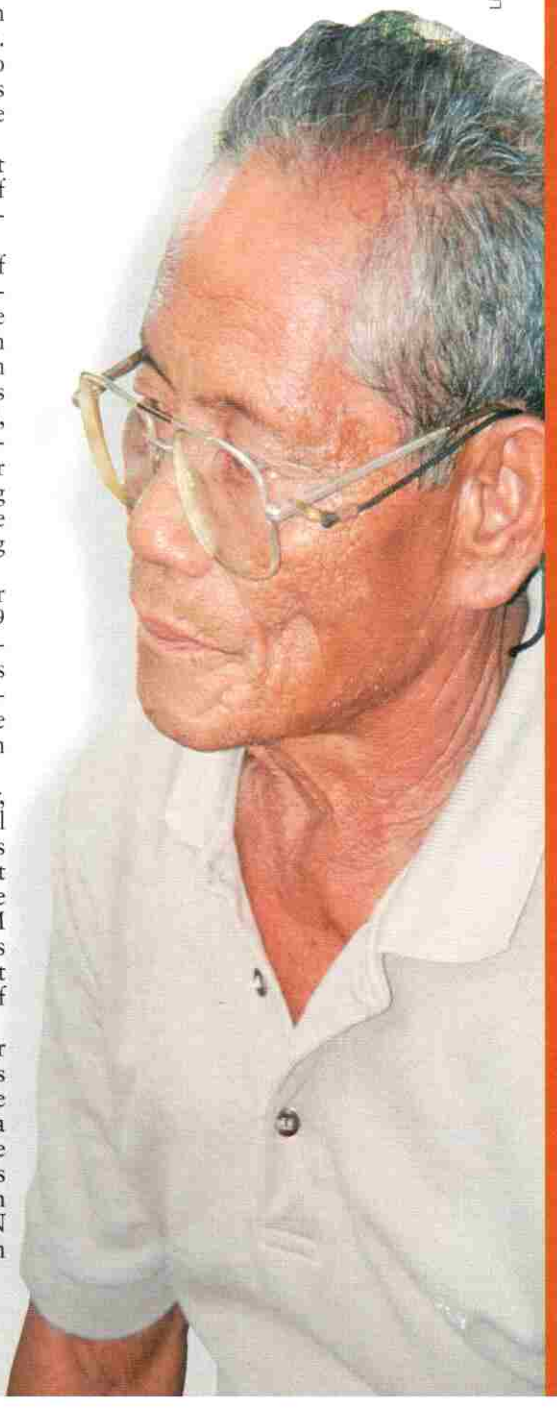
A pilot FFS was set up after that trip. When the national programme was launched, the school became its cornerstone. During the five-year programme which ends in 1998, some 200,000 rice, vegetable and corn farmers are expected to be trained in IPM.

As the programme draws to an end, an evaluation is being undertaken by a team headed by Dr Medina. The results of this evaluation are expected to determine the future direction of IPM in the Philippines. ■

Linda Bolido is *People & the Planet* correspondent in the Philippines.

**Bottom left: Dr Jose Medina**
**Top left: IPM demonstration farm**
**Left: Green rice adult leaf hopper**
**Below: Yellow stem borer moth**
**Below right: Benigno Candia, fisherman-turned-farmer**

Linda Bolido



Nigel Cattlin/Holt Studios International

# The drylands challenge
# Sustaining Africa's soil

The continuing problem of feeding growing numbers in the African drylands has heightened the search for new solutions. Here **Camilla Toulmin** reports on moves towards more sustainable farming.

On a good year, the miracle of rain falling on dusty ground transforms Africa's drylands into a lush ocean of greenery. Kingfishers swoop over temporary ponds, shoots of grass, intensely green, push their way through the soil, and bright flowers – yellow and red – catch the eye. Villages disappear for months behind a thick green wall of millet stems and cattle grow fat and glossy.

Yet such miracles are not assured, rains may fail or fall at the wrong time, pools in the bush dry early, and the millet crop wither into a brittle husk on the stalk. Survival in the drylands presents a complex challenge to farmers and herders who must try and prosper amidst high levels of risk and uncertain returns.

The farming and grazing lands which make up Africa's arid, semi-arid and dry sub-humid zones are estimated to cover around 21 per cent of the surface area, and provide a home to a quarter of Africa's population. Thus, these areas are anything but marginal to Africa's land mass and peoples, and provide major crops such as cotton, groundnuts, millets and sorghum as well as the grazing for millions of livestock.

Physically, dryland soils tend to be poor in nutrients, low in humus, and vulnerable to erosion by wind and water, particularly at the start of the rains, when the earth is bare and lies exposed to intense storms. Rainfall has always been highly variable, with big swings in the amount received from one year to the next, and between one village and its neighbour, but there is now growing concern that parts of Africa are becoming drier and less hospitable to life.

Certainly in the West African Sahel, the past 30 years have seen less rain than the previous 30. Similar evidence is now accumulating for southern Africa, which experienced during 1986-95 its hottest and driest decade ever, with several serious droughts in the early 1990s. As for the future, it is not clear how global warming will affect Africa's drylands. However, even though rainfall may well increase, this is likely to fall in fewer more intense storms, with much lost through higher levels of evaporation and runoff.

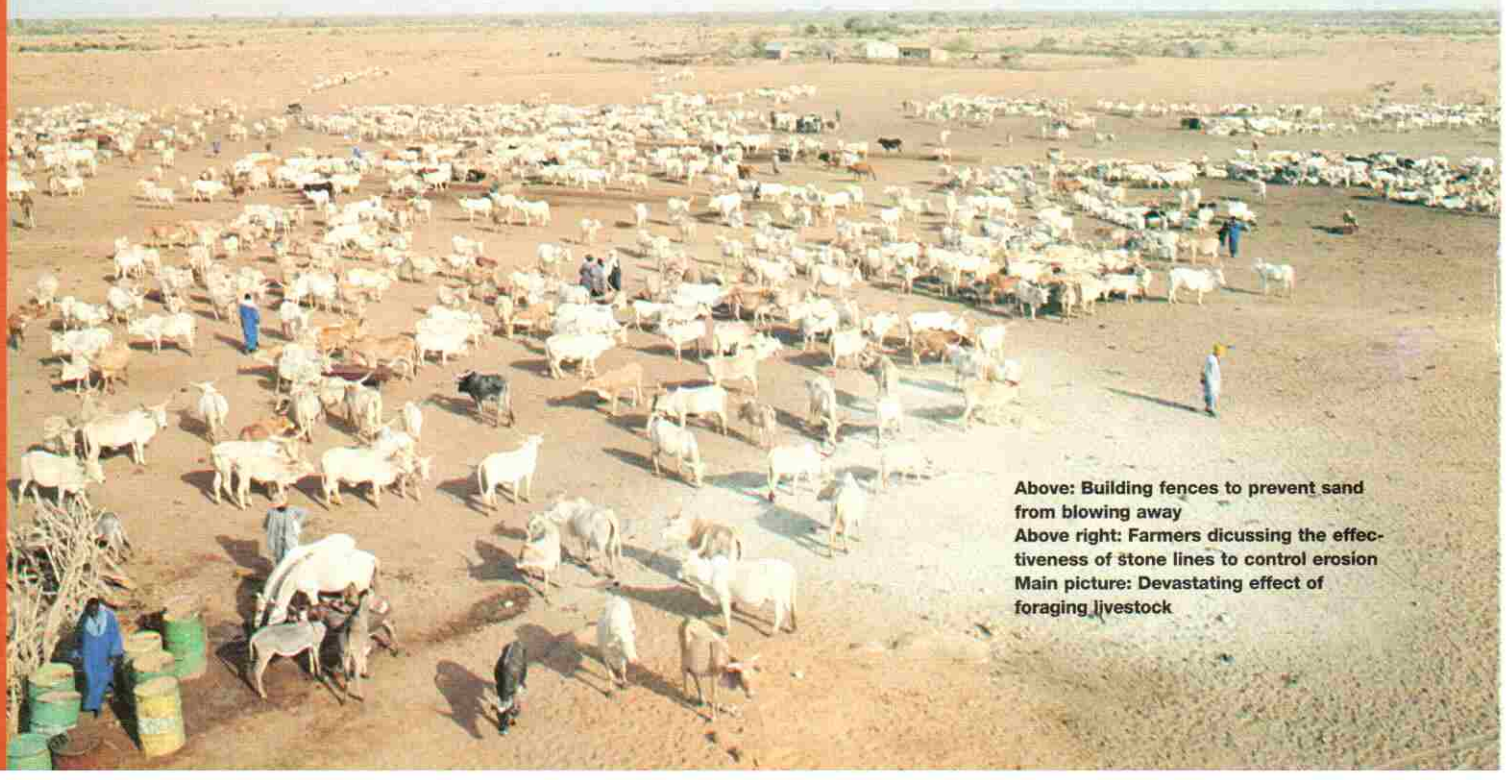
Such a scenario for the climate of the future points to the importance of more effective systems to capture rainfall, and reduce runoff through better vegetative cover and various physical barriers, such as stone bunds, terraces, and trash lines, to make best use of what moisture is available to plants.

Approaches to agricultural development in dryland Africa have undergone a profound shift over the last 30 years. In the 1960s and early 1970s, much faith was placed in the power of science and technology to transform traditional farming systems through mechanisation, high yield varieties and capital improvements, such as irrigation schemes. The impact of repeated droughts, and poor performance of such capital investments have caused a change in emphasis over the last decade. Now the search is for more sustainable agricultural systems, aiming to assure a harvest rather than spectacular yields, and building on the knowledge and skills of local farmers, rather than on imported technologies.

This shift in approach has been matched by a parallel move away from heavy government involvement in economic planning and land man-

Jorgen Schytte/Still Pictures

Jeremy Hartley/Panos Pictures



**Above: Building fences to prevent sand from blowing away**
**Above right: Farmers dicussing the effectiveness of stone lines to control erosion**
**Main picture: Devastating effect of foraging livestock**

agement towards a recognition that such ambitions are both unrealistic and damaging. Instead, governments, agencies, researchers and other actors need to find ways of working with local farmers and herders along the grain of their self-interest, instead of trying to get them to do things based on outsiders' priorities and perceptions.

A recent book highlights the lessons to be learned from examining what farmers are currently doing to manage their soils, develop new techniques and adapt to changing conditions. *Sustaining the Soil: Indigenous Soil and Water Conservation in Africa** brings together 27 case studies from across Africa. These demonstrate the great diversity of farmer practice: from the use of grass as mulch to add body to soils and reduce evaporation in Burkina Faso, and the creation of tiny garden plots for onion cultivation on the Dogon Plateau of Mali to the capture of flood waters in the wadis of Darfur, western Sudan and the digging of a honeycomb of pits across the slopes of the Matengo highlands in south west Tanzania.

Mark Edwards/Still Pictures

However, far from such 'indigenous' methods being cast in unchanging traditional mould, the stories described in the book show the continuous process of research, experimentation and adaptation in any farming system which allows it to evolve, survive and prosper in the face of changing circumstances.

There are many examples of how individual farmers have picked up and adapted techniques to suit their needs. In the north west of Burkina Faso, Aly Ouedraogo from the village of Gourcy has reclaimed many hectares of barren land over the last 15 years, turning a hard pan, gravel surface (known as *zipelle* in the local language) into productive fields, able to produce dense stands of sorghum. Aly's household can now feed itself each year.

Such a transformation of the land has been made possible by mixing several techniques – stone lines reinforced by seeding of perennial grasses and fruit trees, while areas between the stone lines have been dug with planting pits (or *zai*). The *zai* not only harvest rainfall runoff but also catch drifting soil, dried leaves and other matter, which termites break down. At harvest time, Aly leaves at least 20 cm of stubble from the crop to slow wind speeds and provide further material on which termites can feed, while a compost and manure pit on the edge of his field provides a handful of fertiliser for each *zai*. Aly spends most of his day walking around his fields even during the dry season, keeping a watchful eye out for stray goats eager to nibble at the young trees he has established.

In neighbouring Niger, ten farmers from the Tahoua region were sent to visit farmers like Aly Ouedraogo to see for themselves what zai can do to transform encrusted soils. On their return, this simple pitting technique combined with a handful of manure in each hole has rehabilitated thousands of hectares of land which had been abandoned. So attractive are such measures that farmers now buy degraded land in order to turn it back into productive fields through the zai method.

On the other side of the continent, farmers in the highlands of northern Shewa, Ethiopia, have been using drainage ditches across their fields for centuries, as a means of protecting land from being washed away when rains are heavy, and to reduce surface runoff. The widespread use of such systems contrasts with the huge terracing programmes carried out in the Ethiopian highlands, supported by government and donor agencies through the 1980s, where food for work was used to gain the 'participation' of local people in doing the work. However, having played no role in planning and designing these systems, local farmers felt no sense of ownership or interest in these structures which now lie abandoned and unkempt.

Africa's farmers constitute an important resource on which to build more sustainable agriculture in future. But such systems must develop on the basis of the particular local conditions and opportunities which farmers face. Drylands are remarkably diverse in terms of the patchwork of resources available in a given site, as well as the market opportunities available from which incomes can be derived. Farmers have a choice in how they use their time and money, so if they are to invest in better methods for managing soils, water and nutrients, they must be assured of a reasonable return for their labours.

Promoting people's participation has been the most widely used slogan of the development 'industry' over the last decade. It sounds appealing, and as can be seen from *Sustaining the Soil*, there is much that farmers have been doing which demonstrates the value of such participation. But trying to make participation happen is by no means a simple task. Local communities are never homogenous social groups, but are made up of differing interests – young and old, women and men, poorer and richer. It may be much easier to promote the participation of better-off, more powerful groups in a given programme, but much harder to ensure that the opportunities and benefits from participation are more evenly shared.

Promoting participation also provides a major challenge for governments and development organisations, which usually prefer a well-planned and predictable programme of work, rather than support to a medley of different activities. However, although it may look untidy, a diverse and locally tailored approach is the only means to build effectively on farmers' knowledge and skills, the specific conditions in their local environment, and the priorities they face in their daily lives. ■

Camilla Toulmin is Director of the Drylands Programme of the International Institute for Environment and Development.

* Reviewed on page 30

Living in a rocky and semi-arid environment, the Dogon of Eastern Mali have created one of the most remarkable traditional systems of sustainable agriculture in the world. Now they are struggling to maintain its sustainability in the face of rapid population growth and climate change. Contributing Editor, **Paul Harrison**, reports from the village of Kamba-Sareme.

# Making land fr

South of the Niger bend, the Dogon plateau rises in long ridges of red granite with seams of gravelly ironstone, sloping gradually upwards towards a steep escarpment which drops abruptly down towards the plains of the Yatenga.

The Dogon came here at least seven centuries ago and stayed, defending their territory against successive waves of Muslim conquerors. Yet the land itself is as hostile as any assailant: narrow valleys of thin sandy soil among vast expanses of bare rock, and a semi-arid climate that gives no more than three months of rain a year.

Yet traditional irrigated Dogon agriculture is probably the most intensive and productive in Africa. Every square centimetre of usable soil is planted, every gramme of plant or animal waste is recycled to achieve yields that for some crops rival those of any Western market gardener. "They are extremely skilled irrigators," says agronomist Chris Reij. "What they achieve is miraculous."

The Dogon have developed almost all their impressive array of soil and water conservation techniques by themselves, and the reason for the intensity of their farming is linked to population density.

**Left: Because land is scarce even narrow crevices are used to grow beans and millet**
**Below: Women spend hours pounding millet**

Paul Harrison

In most of Africa land has been abundant. Until recently, fields could be shifted every year so the land could rest and recover lost fertility naturally.

But the Dogon were concentrated for defence reasons in a restricted area, and their population density has for centuries been much higher than average for Africa. Fallow periods soon became impossible on much of the land, so the Dogon had to find other ways of restoring soil fertility. They also developed an impressive array of soil and water conserving techniques.

The stone-built houses and straw-capped granaries of Kamba-Sareme cluster on a rise in the centre of the Dogon plateau. Some 95 per cent of the village land is bare rock or boulders. Almost all the cultivable land is concentrated in three narrow valleys that drain southwards into a fourth.

Forty years ago the village had just ten households. Today it has 39. Sixty-year old Raphael Djiguiba has five younger sons and three daughters by his two wives. One son is working permanently in Abidjan in the Ivory Coast. Two teenage boys are at primary school in Bandiagara, 25 kilometres away. His eldest son, Matias, aged 36, is practically the head of the family. Matias and his wife Agnes have four children of their own – so the family land has to feed thirteen people and pay school and lodging expenses for two.

There's one millet field, a narrow band about six metres wide that snakes for a couple of hundred metres around the contour below the boulders. Then there are seven other small patches scattered among the valleys. Every patch is used to the full potential of its soil, slope and water availability.

Every square centimetre of soil is used. On the bare baking rock ledges, crevices only 20 centimetres wide, as long as they have a little soil, are planted with millet and beans. Narrow hollows among huge boulders are planted with millet, thatching grass and gourds whose fruit and massive spread of foliage drape over the rocks.

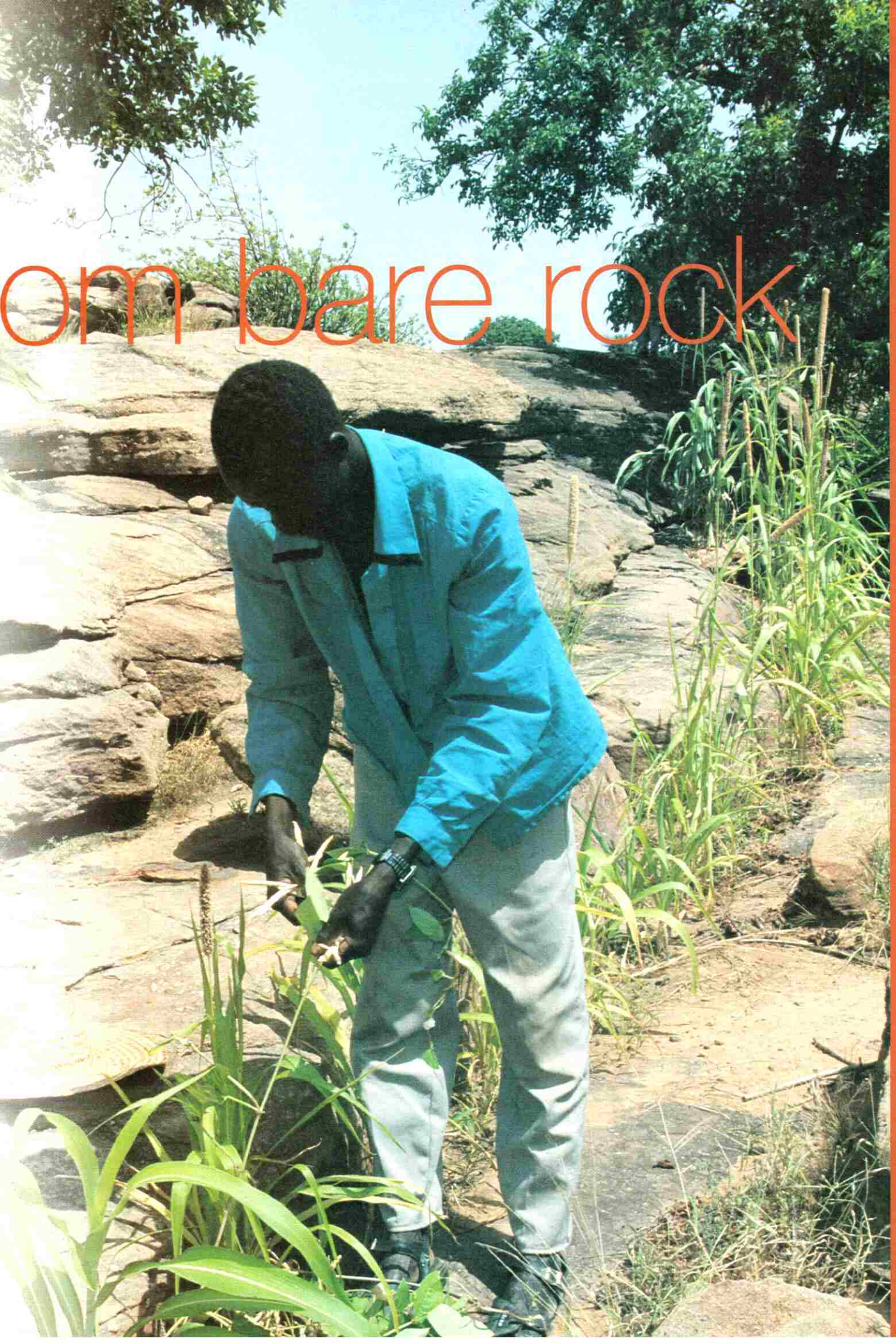
The crops are carefully selected to make the most of each site. On the millet field, millet is intercropped with varying proportions of sorghum and haricot beans. Sorghum does better in a wetter year or site: as rainfall has declined, the share of sorghum has been cut back. Dryer fields grow the fine-grained grassy cereal fonio; damp spots grow rice; patches near water are for irrigated vegetables: onions, tomatoes, aubergines, marrows, courgettes, gourds, peppers.

Like all Dogon farmers, Matias is a careful conserver of soil and water. When the millet is weeded, the waste is raked into mounds 15-20cm high in between the stalks. These create a trellis of bumps and hollows which brake the runoff of rainwater and allow it to filter in slowly without eroding the soil. The mounds, rich in humus from decaying weeds, are used to plant the next year's seed.

Along the field's downhill edge, rocks are piled in long lines roughly level with the contour. These partly dam back the water flow and hold in soil to reduce erosion. Matias has built several lines on bare rock: gradually soil is building up behind them and in a few years he hopes to start cultivating.

Despite these measures, Dogon yields for rainfed crops are poor – generally below the low African average of 600 kg per hectare for millet. The average family produces only one third of its cereal needs, and has to buy the remainder with the sale of market vegetables – mainly onions, for which the Dogon have been famed for over a century.

The Dogon's most remarkable technique, unique in Africa, is the



# om bare rock

Paul Harrison

creation of new land by making soil terraces on bare rock. Matias showed me his latest creation – a square enclosure about seven metres by eight, on a broad shelf of rock sloping down to a stream that flows from June till February. It took him seven long days in the dry season to make – two days to break rocks and build the enclosure wall, and another five carrying sacks of soil dug out of crevices and dried up seasonal ponds, and compost from his home compound.

Once the terrace was built and filled, Matias placed extra stones to create a patchwork of one-metre squares – these act as micro-basins, and retain water and soil. When I visited in September, Matias was weeding, piling the weeds and attached soil behind a new line of stones to form the start of a new patch which he would fill in next year.

Soil fertility is carefully maintained. Back at his house Matias has dug a compost pit among the rocks where all the family's wastes and wood ash are dumped, along with extra leaves collected from under trees. At night the goats and donkeys are tethered here, so their droppings and urine enrich the mixture. Before planting, Matias brings five sacks of compost for his new terraced patch.

The heaviest part of the work is watering, every two days. Matias fills big calabashes in hollows that the stream has worn in its bed, and tips them over his outstretched hand to spread the water (see inside cover).

The total labour input on these artificial irrigated patches is massive – for onions it is around 1400 person-days (almost four person-years) per hectare, not counting the time it takes to create the land in the first place. But the output is also extraordinary. The Dogon achieve average onion yields of 42 tonnes a hectare – equal to the US yields, which are the third highest in the world.

But the struggle for subsistence and sustainability is never won. Every year the Dogon area sees natural population growth of well over 3 per cent per year. Even after heavy emigration, the plateau has to absorb annual population growth of around 1.7 per cent (see box).

On top of this comes climate change. There has been a striking shift in rainfall. From 1920 to the late 1960s, the average rainfall in the area was 620 mm a year. Since 1970 the average has plummeted to only 450 mm. This is often patchily distributed, so that crops may go thirsty at crucial growth periods. "If only we could get two good years' crop in a row, we could do much better," Matias complains.

Drought plus rapid population growth have taken their toll on the land. Tree, shrub and grass cover have dropped and the soil, more exposed to rain, erodes faster. From the 1970s on, clay and silt particles lodged in the cracks between sandy ones in the denuded areas, forming a hard carapace which prevents rain from penetrating. On many slopes the last vestige of soil has gone leaving bare rock and patches of gravel.

The changing environmental and demographic situation has demanded an unending flow of adaptations. There is a continual drive to expand the area of artificial land by building new soil terraces and stone lines on the rocky or crusted areas.

The irrigated terraces can only be built near water, so there is a parallel drive to create new water sources. After the 1974 famine, aid organisations began to help villages to build dams to ensure a more reliable water supply for more months in the year. Kamba-Sareme's villagers built a first dam in the fourth, transverse valley. Two more were to follow here. Another two dams were built closer to the village. Four out of the six dams they financed from their own funds, collected through the local peasant organisation Molibemo, aided by Britain's Oxfam.

The dams made it possible to cre-

**SUSTAINABLE MARKETING**

Sustainability is a concept that embraces human as well as environmental requirements. The needs of future generations must be respected – but those of the present generation must be met, too.

Meeting present needs is not just a matter of producing enough food, but of achieving decent prices for the crops that are sold. If prices are too low, then farmers are forced to extend the area they cultivate, or to cut back fallow periods without replacing lost fertility.

The Dogon on average produce less than 40 per cent of their own cereal needs, so they rely on the sale of cash crops to fill the gap. Until recently it was very difficult for them to get a decent price for onions, their main cash crop. Prices vary enormously – in 1996 it was 120-130 francs CFA in February-May, just after the harvest, rising to 300 in September, when seed onions are needed, and up to 500 in December.

In a year of bad millet harvests, farmers would sell all their onion crop immediately, to buy food. By the end of the lean season, grain prices and seed onion prices would both be high while cash reserves would be low. Farmers were often forced to buy both on credit from traders, at ruinous interest rates, and under conditions that obliged them to sell the following onion crop at lower-than-market prices.

In 1989 a Dogon peasant association was created, linking many existing village groups, to focus self-help efforts. Molibemo (which means let's help each other) includes 102 villages in the Dogon region. With Oxfam's help Molibemo provided loans for villages to create onion seed banks, with improved granaries to reduce storage losses. These are stocked up in February when prices are low, and resold later at prices much lower than traders sell for. Farmers strapped for cash can take out loans to buy their seed onions, and repay later at a low rate of interest.

GTZ has also introduced cheap appropriate technology for drying onions, which allows farmers to hold their stock back for much longer without fear of drying out or rotting, and get higher prices later in the season.

Coupled with rising demand due to urbanisation, these two developments have improved onion prices and increased the farmer's share of the market price. These contributions to sustainability are just as important as technological changes.

ate several hectares of new onion patches on what was previously bare rock.

Further adaptations, researched by the German technical aid organisation, GTZ, are still feasible. The stone lines can be improved in design and made more efficient by placing them exactly along the contour lines, using a cheap level made from two marked sticks and a length of clear plastic tubing filled with water. Living barriers can also be aligned along the contour to hold back soil and water – hedges of nitrogen fixing trees or shrubs, or bands of thatching grass.

Some problems seem at present intractable. At Kamba-Sareme all five dams are dry by the end of March, and only one small spring continues to provide a meagre trickle of water for drinking until the first rains in June. Neighbouring villages now all have tubewells, but a borehole at Kamba-Sareme found no water above bedrock level.

Cutting firewood is a crushing burden for Matias' wife Agnes. During the dry season when there's no work in the fields, she spends four to five hours every day, on a gruelling round trip of six kilometres up and down steep hills, to get firewood. This she stockpiles so it will last through the farming season. This comes on top of four or five 20-minute trips every day to get water, plus a couple of hours pounding millet. Drought and deforestation have lengthened the tasks of water and fuel collection considerably, but rebalancing the sexual division of labour is one adaptation that the Dogon haven't even started on yet.

Planting trees closer to home would reduce the workload, but trees need deeper soil than crops and the area where trees could be planted is shrinking. Matias has planted a few neem trees on the rocks around his home, building circular walls and filling them with soil, but when they are bigger they may be vulnerable to toppling by sudden squalls.

The Dogon experience has many lessons for sustainable agriculture. Along with many other indigenous African soil and water conservation techniques (see review, page 30), it refutes the myth that African farmers are slow or reluctant adapters of new approaches. On the contrary, they adapt with a speed unrivalled anywhere else in the world, and will readily switch crops and technologies from one year to the next if they know they can benefit.

### POPULATION – THE RISING PRESSURE

Population pressure on the Dogon plateau is among the highest in Africa. In the Bandiagara district the population of 190,000 has a natural growth rate of 3.2 per cent a year. At current rates the average woman would have 6.6 children in her lifetime – and that is about one less than the ideal family size of women questioned for to the Demographic and Health Survey (DHS) of 1996-97.

All the classical factors underlying high fertility are present. There is a massive under-five mortality rate – 380 children out of every 1,000 die before their fifth birthday. Two thirds of all births come into high risk categories (where the mother is under 18 or over 35, or pregnancies are too many or too closely spaced). Maternal causes account for one third of all women's deaths between the ages of 15 and 49.

Modern health services are unavailable in most rural areas – the average rural person is at least three hours travel away from the nearest basic health facility, and five hours from the nearest hospital.

Education provision is scarce – the nearest primary school to Kamba-Sareme is 25 kilometres away, so children have to board with relatives. Four out of five women have no education at all, and only one in 18 is literate.

In the Dogon area knowledge of contraception is very low – only 40 per cent of women know of any method. Modern methods are available only in a handful of larger urban centres. In the Mopti region a minuscule 1.4 per cent of women use a modern method – in the Dogon area the proportion is lower still.

The Dogon do control their fertility – child-spacing as long as three years is common. So abstention and withdrawal are probably more common than the survey suggests.

But thought of limiting the number of births is still very far off.

I asked Agnes Djiguiba how many children she would like. "As many as God sends," she laughed. "Even 15?" "Even 20," Matias chipped in. "If you've not got enough land now," I asked, "then how will they survive?" "They'll get by. Some will go to Abidjan and send money home. Some will go to Bamako and be civil servants." It's clear that emigration is seen as the safety valve for local problems. Women's education, health and family planning must all improve considerably before limiting the number of births is seen as another necessary adaptation.

The Dogon are a clear confirmation of the Boserup* theory that population density is what drives farmers initially into techniques for restoring soil fertility and conserving soil. But that process has not reached an end. Continuing rapid population growth, combined with climate change, keep up a heavy pressure to improve techniques and to create new land each year.

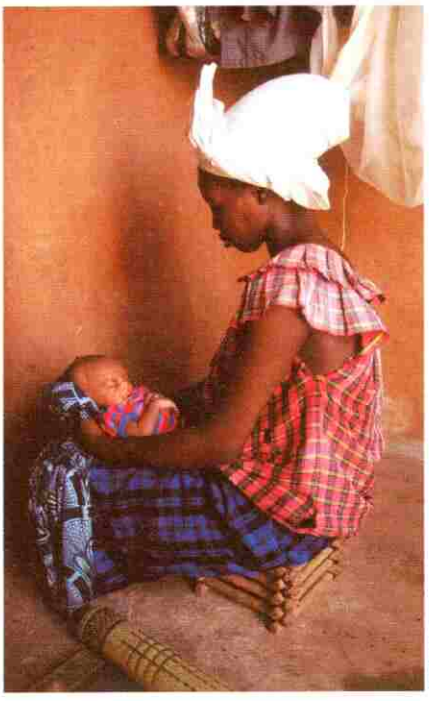
What the Dogon show most clearly is that there can be no stable sustainable agriculture, as long as there is population growth, climate change, changing expectations of income, changing markets and changing technological options.

There is only a continued struggle to develop and apply feasible techniques that maintain or improve the soil, while providing a tolerable living for the people who depend on it. In a world that is continually changing, sustainable agriculture is not a state: it is a process. ■

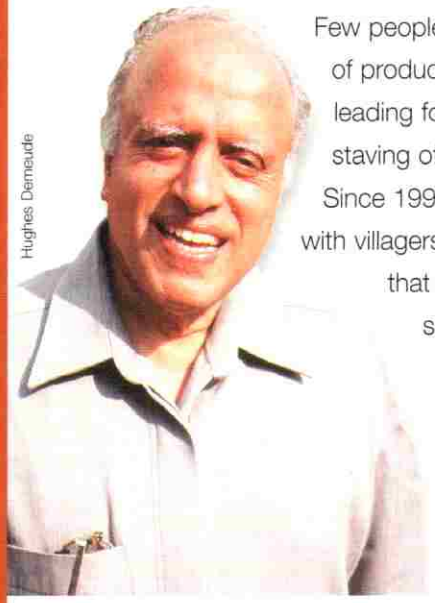
Paul Harrison is author of *The Third Revolution*, Penguin, £6.99.

*Esther Boserup, *The Conditions of Agricultural Growth*, Unwin University Books, 1965.

**Left: Picking out onion seedlings on terraces built on bare rock. The Dogon achieve one of the highest onion yields in the world**
**Below: The Dogon have both high fertility and high infant mortality rates**



Paul Harrison



Hughes Demeude

Few people exemplify the paradigm shift from yesterday's high-technology solutions to the problem of producing enough food for growing populations better than Professor Swaminathan. One of the leading forces behind the Green Revolution, he is now convinced that the sustainable solution to staving off hunger lies in the new, more gentle formula of 'eco-development'.

Since 1991, the MS Swaminathan Research Foundation based in Madras, India, has been working with villagers in the southern state of Tamil Nadu to increase awareness about farming techniques that increase yield – and preserve soil fertility. Villagers, particularly women, are also taught simple home-based production processes such as mushroom cultivation and floriculture that lead to eco-jobs and supplement farm incomes.

The entire programme is rooted in the concept of the 'biovillage', a holistic, socially-sustainable village where development benefits all living organisms. About 19 biovillages have been established so far; the Foundation hopes these will be replicated throughout India. In this interview with Bishakha Datta, **Professor Swaminathan** discusses the philosophy behind the biovillage, and elaborates on his vision of sustainable agriculture.

# Creating an e

What do you see as the key challenge for agriculture today?

**Dr Swaminathan**: First of all, since we have just celebrated 50 years of India's independence, let me say that political freedom is an illusion without basic economic freedom – and that means freedom from hunger.

Today in India, we have reached food self-sufficiency in terms of the available purchasing power. It is not self-sufficiency in terms of need, but self-sufficiency in terms of the available purchasing power of people. This is all they can buy, because today our problem of food is not one of production. It is one of access. People have no money. Where there is money, there is food. And where there is work, there is money. So it has now come down to the issue of livelihood security. If people have got sustainable livelihoods, then they are able to earn money and have food.

Of course, we cannot feed the people of this country without producing more. So the challenge is also this: we have 16 per cent of the world's population, we have nearly 16 per cent of the world's cattle population, 2 per cent of the world's arable land, 1 per cent of the world's rainwater, 0.5 per cent of the world's forest, and 0.5 per cent of the world's pasture land. Now we need to produce more and more food and other agricultural commodities from less per capita arable land and less water. How do we do it?

Hughes Demeude

In other words, the problem has intensified. What do you see as the solution?

I feel the solution is what we call Integrated Intensive Farming Systems. In other words, we have to have multiple enterprises for farmers. Crops alone cannot generate enough marketing surpluses or incomes, no matter how high the price of crops is.

What is now needed is for farmers to have multiple sources of income. For instance, some animal husbandry, some medicinal agro-forestry, some fuelwood. And value addition to their products, to every product. Sometimes in our biovillages, we take very poor people and make them seed producers, because seeds fetch more money, so this is value addition to their time, value addition to their labour.

Also, over 60 per cent of our cultivated areas is rainfed. No irrigation. So what do we do with rainfed farmers? We feel they must harvest water and use the water for value addition. They must have high value crops: pulses, oilseeds and others.

Hughes Demeude

What we are now saying is: take a whole systems approach – don't just look at producing a little more wheat, a little more rice, but look at the farming system as a whole. And do not either worship the old or abhor the new. Try to get the best blend.

Today, what we need is knowledge-intensive agriculture. Fifty years ago, it was more a capital and chemical-intensive agriculture. Today, we need knowledge and biological inputs or farm-grown inputs. We have to have a whole new approach: modern technology, precision farming. We must measure yield per drop of water like the Israelis do. And above all, we must declare groundwater as public property, not private property.

People cannot go on over-exploiting the aquifer.

### You mentioned the biovillage. What is a biovillage?

The word biovillage comes from the Greek word bios, which means living. A biovillage is one where the living person becomes the centre of both planning and implementation. In a biovillage, the whole planning is done by the people for their own benefit.

When we use the term bios, we mean not only human beings, but also animals, plants, community property resources, the environment. So you have something where planning is for the total betterment of all living organisms, not one at the cost of the other. It's a holistic symbiotic plan.

We coined the term biovillage to indicate a village in which there are convergences among various aspects of development, which is socially sustainable. We call it a pro-nature, pro-poor and pro-women orientation leading to a job-led economic growth strategy, not a jobless economic growth strategy.

### How is food grown in a biovillage?

Through what is known as sustainable agriculture – what I call the evergreen revolution.

Let us say I have to produce eight tons of wheat. Each ton requires about 25 kilos of nitrogen, so 200 kilos of nitrogen will be needed. If I use 200 kg of mineral fertiliser, like urea, we will have groundwater pollution, nitrate pollution and so on. So now our philosophy is – give part of this through green manure, because ours can be a multiple-cropping society. We have a green manure crop which can fix about 60-80 kg of nitrogen. That is a very powerful step we are taking.

We also use crop rotation effectively, by growing other crops (such as berseem every two years). Berseem fixes nitrogen and it's a good fodder. So crop rotation. Green manure. Biofertilisers. And whatever organic manure you can get. If you don't have anything at all, at least take some part of the stem to plough it back.

### So what you would advocate is a combination of chemical and organic techniques?

Yes, very much so. Integrated pest management does not mean avoiding pesticides completely. Integrated nutrient management doesn't mean no fertilisers.

### Does the integrated system have the same potential to increase yields as a more technology-intensive system?

The integrated system is itself highly technology-intensive. It brings the best in modern technology. For example, we use geographical information system mapping to make decisions. We use information technology – the whole irrigation system, fertiliser application, pesticide application are computer-determined, and require a lot of location-specific information.

The new technology is more knowledge-intensive, therefore we need the best information technology. We use technology that can convert generic meteorological information into micro-meteorological information. Similarly, marketing and management information has to be converted to the micro-level. We apply the best in bio-technology in terms of value addition to products, propagation by tissue culture and so on. So the new technology is really harnessing the frontiers of science and technology in such a way that the ecological problems associated with the earlier technologies are not there.

Yields compare very well in the integrated intensive farming system once you learn it. Yields may drop in the first year, but once you start mastering it, you get not only higher yield, but more sustained yields. Secondly, the cost of production drops because you're substituting knowledge and farm-grown inputs for market purchases. For instance, in our green cotton movement, complex NPV viruses, which are crucial in controlling bollworm and other insects, are all being produced by village women in their own homes, in their own huts.

Hughes Demeaude

Hughes Demeaude

**Top left: Professor M.S. Swaminathan**
**Middle left: Organic compost**
**Bottom left and above: Increased yields on the same land**
**Below: Seedlings for better crops**

# vergreen India

### How would you define sustainable agriculture?

We define it in terms of social sustainability. My conviction is that today's technology and development path has in-built seeds of discrimination against the poor. Look at the latest UNDP report – 85 per cent of the world's income goes to 1 billion people, while another 1 billion people live on less than $1 per day. And it's getting worse. At the time of the Earth Summit in Rio, 1992, the proportion was 80:20. During the first UN conference on environment and development at Stockholm, 25 years ago, the proportion was 70:30.

The concept of sustainable agriculture in affluent nations is different from the concept in a poor nation. In industrialised countries the problem is to preserve the high standard of living. In the poor countries the problem is to get some standard of living for most of the people.

Therefore it's an opposite paradigm. They look at sustainability from a more environmental perspective, while for us sustainability is environmental, social and related to gender equality. We have to think of these issues concurrently. That's what we do on our research programme. We put a matrix of questions: is it socially sustainable? Is it pro-women? Is it ecologically sustainable? And of course, is it economically viable? ■

Bishakha Datta is *People & the Planet* correspondent in India.

# Associates' news

## POPULATION GAP

The World Bank – the most influential financial institution in international development – should strengthen its role in helping developing countries slow population growth as agreed at the International Conference on Population and Development (ICPD) says a new study from Population Action International (PAI).

The study, *Falling Short: The World Bank's Role in Population and Reproductive Health*, identifies the Bank's inconsistent attention to population issues in negotiations with developing countries and its need for trained staff with expertise in reproductive health and family planning, as two priority areas for action.

"The World Bank has unparalleled influence at the highest levels of government in many developing countries," says Shanti Conly, lead author of the study. "Too often, however, population concerns are not adequately integrated into discussions of a country's development needs."

According to PAI, the Bank tends not to differentiate between 'population' – a broad, cross-cutting development issue – and family planning, which is an essential element of basic health care. Population falls largely under the health sector, rather than being integrated into the Bank's overall approach to development.

Sean Sprague/Panos Pictures

PAI argues that the World Bank needs to ensure that adequate attention is paid to improving health services, including reproductive health and family planning. Moreover, PAI's analysis indicates that in 1995 and 1996, lending for family planning alone was roughly half the level of the early 1990s.

"The Bank is uniquely positioned to help developing countries implement the Cairo Action Plan," says Shanti Conly. "Given that, in these countries, one-third of diseases affecting women in their childbearing years is due to poor maternal and sexual health, the Bank should do more to ensure that an adequate share of resources go to this crucial area of health."

For a copy of the report contact:
PAI, 1120 19th Street, Suite 550, Washington DC 20036, USA.
Tel: (+1 202) 659 1833, Fax: (+1 202) 293 1795.

## HEALTH INFORMATION

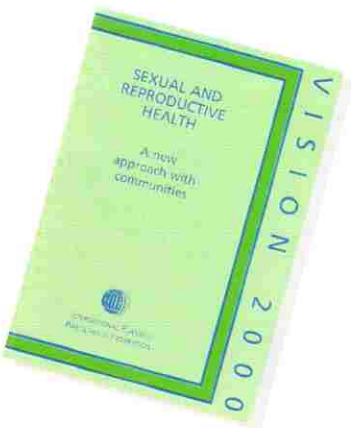
Three books providing sexual health information for a worldwide audience were launched during the September meeting of IPPF's International Medical Advisory Panel (IMAP).

*Family Planning Handbook for Health Professionals: The Sexual and Reproductive Health Approach* is an updated version of the popular Family Planning Handbook for Doctors. It is now intended not only for doctors who provide contraceptive and family planning advice and sexual and reproductive health care, but for nurses, midwives, counsellors and others working in the field. It covers in detail all the methods of family planning, and also includes chapters on related subjects such as infertility, management of unwanted pregnancy, sexually transmitted diseases and contraception for adolescents.

The updated *Medical and Service Delivery Guidelines for Family Planning*, first published in 1992, gives concise instructions on how to help clients make their own choice about their fertility while promoting and protecting their overall reproductive health. New chapters cover reproductive tract infections (now estimated to be responsible for a million deaths a year), infection prevention and control, emergency contraception and diagnosis of pregnancy.

The third book, *Sexual and Reproductive Health: A New Approach With Communities*, is based on IPPF's experience over a number of years in helping local family planning associations form partnerships with communities to improve sexual and reproductive health. It draws on the experiences gained from a project involving six family planning associations – in Burkina Faso, Dominican Republic, Gambia, Ghana, India and Tanzania, and offers a basic framework for implementing the community approach.

Prices on application from Distribution Unit
IPPF, Regent's College, Inner Circle,
Regent's Park, London NW1 4NS, UK.
Tel: + 44 (0)171 487 7900,
Fax: +44 (0)171 487 7897,
Email: csavage@ippf.org




## MOBILISING WOMEN

A new initiative to strengthen civil society in Nigeria by increasing women's participation in the political system has been launched by the Centre for Development and Population Activities (CEDPA) in collaboration with Johns Hopkins University/Population Communication Services.

This Nigerian Democracy and Governance Initiative, supported by the United States Agency for International Development (USAID), will build upon the existing programme of small grants, training, and technical assistance to community-based partner organisations representing more than 21 million women throughout the country.

The initiative places particular focus on three areas: expanding women's participation in politics and the democratic process, empowering women, and strengthening fundamental human rights.

*Women on the Move*, a 36-page colour booklet relating the experiences of Initiative participants, is available and a training manual is in preperation from CEDPA.
Contact: CEDPA, Communications Division,
1717 Massachusetts Avenue NW,
2nd Floor, Washington DC 20036, USA.
Tel: (+1 202) 667 1142,
Fax: (+1 202) 332 4496,
Email: email@cedpa.org

Mark Edwards/Still Pictures

## POOREST COUNTRIES

The rapid expansion in the population of the world's poorest nations may not have peaked according to the latest UN population projections.

The countries classified by the UN as 'least developed' are growing at about 2.6 per cent per year, a rate that would double their population size in only 27 years. This can be compared to all less developed countries, where the annual growth is 1.8 per cent, still far higher than in the industrialised countries of Europe and North America.

The UN classifies less developed countries (LDCs) as all the countries of Africa, Asia, Latin America, and Oceania (except Australia, Japan and New Zealand). With 4.7 billion people, LDCs contain 80 per cent of all world population, a percentage that is continually increasing. The least developed countries are a subset of the LDCs and constitute what might be the poorest of the poor.

Today, the least developed countries contain about 600 million people, twice their population in 1970. By the year 2050, the UN projects that their population will total anywhere from 1.4 to 1.9 billion and will still be growing.

Least developed countries include Ethiopia, Democratic Republic of Congo (Zaire), and Sierra Leone in Africa; Bangladesh, Cambodia, and Nepal in Asia; Haiti in Latin America, and Western Samoa in Oceania.

Contact: Carl Haub at
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Email: carlh@prb.org

*Associates' News is compiled by* **Maya Pastakia** *to whom all contributions should be addressed.*

# Into the greenhouse century

A faltering first step, when a giant leap was needed, was the general verdict as the Kyoto climate summit limped to an exhausted conclusion in early December, *writes Mick Kelly*. After ten days of very public and, at times, acrimonious debate, agreement was reached only after the final session over-ran by 16 hours with resolution of certain critical matters postponed to a later date.

The summit was the Third Session of the Conference of the Parties to the UN Framework Convention on Climate Change. The main item on the agenda was the adoption of a protocol containing legally-binding greenhouse gas emissions controls for the industrialised nations, moving beyond the current precautionary target of stabilisation by the year 2000 with new targets for a new century.

The resulting Kyoto Protocol commits the industrialised nations to reduce their collective emissions of six greenhouse gases by 5.2 per cent, averaged over the period 2008-2012. Carbon dioxide, methane and nitrous oxide reductions are to be from 1990 levels, the existing baseline. For three long-lived industrial gases - the hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride - the baseline can be 1990 or 1995.

A step in the right direction most surely, but, with carbon cuts of some 60 per cent needed to halt global warming, many had hoped for a stronger commitment to mark entry into the greenhouse century.

As the negotiators worked through the night, flexibility proved one way to resolve disagreement. Some parties, such as the European Union, took on cuts of 8 per cent. The United States reluctantly accepted a reduction target of 7 per cent. Other nations may increase their emissions – Australia, for example, by 8 per cent and Iceland by 10 per cent.

Flexibility also extends to the manner in which commitments can be met. Through joint implementation, parties can finance emissions reductions in other industrialised nations and take credit for the outcome. An emissions trading mechanism will permit industrialised nations to buy and sell "excess" emissions credits. Details of these schemes could not be resolved and negotiations will continue over the next year.

Developing nations are not covered by formal emissions controls at this stage of treaty implementation. Third World delegates did, however, play a major part in Kyoto, holding the industrialised nations to their obligation to take the first step in curbing emissions, as explicitly stated in the treaty.

Michael Zammit Cutajar, Executive Secretary of the Convention, pronounced the meeting a success, saying that "the Kyoto Protocol provides for real and significant greenhouse gas reductions." But the event was severely marred by the display of tension, most notably between the United States and other nations. This does not bode well for the future, particularly if and when we move beyond the current precautionary phase and much deeper cuts are required. Many observers felt that the many loopholes could seriously undermine the agreement. And, with the Clinton administration constrained by Senate fears over economic costs, it is not even certain that the United States will be able to ratify the Protocol.

Three issues are likely to dominate the next stage of negotiation and implementation.

Given that many industrialised nations will fail to meet their existing target of stabilisation by the year 2000, serious consideration must be given to means by which compliance can be encouraged, if not legally enforced.

There is likely to be much debate over joint implementation and emissions trading. Advocates argue that emissions trading, for example, is the most efficient means of achieving significant reductions. Others see this as a device for industrialised nations to avoid responsibility for their own emissions. There are serious questions to be resolved regarding monitoring, allocation of credit, fair play and justice.

Growth in emissions is already marked in the rapidly industrialising nations and is likely to accelerate and pressure will be on the South to accept limits on emissions trends. Under what conditions will southern nations accept formal targets? What support will be available from the historic polluters of the North to switch the South onto a greenhouse-friendly development path? This issue may well prove the most intractable unless the tensions evident in Kyoto can be replaced by effective co-operation.

Cynicism was the dominant response as the hot air dissipated over Kyoto. But perhaps disillusionment with this intensely political process will focus much-needed attention on the many and varied ways in which individuals, non-governmental organisations, businesses and governments, in both North and South, are already responding effectively to the threat of global warming by conserving resources, reducing emissions and limiting environmental vulnerability.

People are acting not to meet the dictates of a global convention but because these measures represent plain common sense, of benefit in the here and now as well as in decades to come. Perhaps we are placing too much emphasis on the top-down process of global targets and national emissions control schedules, blind to the more sustainable progress being made at the grassroots.

Mick Kelly is a Reader with the Climatic Research Unit at the University of East Anglia, Norwich, UK, and co-editor of *Tiempo*, a bulletin on global warming and the Third World.

# Books

## CONSUMPTION CHALLENGE

### Sustainable Consumption: A Global Perspective

Manus van Brakel, Bertram Zagema
Friends of the Earth, Netherlands, $10.00

Rich, industrialised countries will probably have to reduce their use of natural resources by a factor of between five and ten times, if the whole world is to achieve a sustainable balance between population, consumption and the environment.

That, at least, is the opinion of the authors of this excellent paperback booklet.

Of course, they acknowledge that neither consumers nor politicians are likely to willingly accept drastic reductions in their comfortable way of life. But if they do not reduce their share of natural resource use, how can the rapidly growing populations of the Southern countries be expected to accept limits on their own opportunities for development?

That is the dilemma to be faced in the coming century. Or to put it succinctly: How can we achieve global equity in the use of environmental space?

What is needed, says this book, is a sustainable consumption policy, which maintains prosperity in the rich countries while reducing the use of natural resources to the level within the environmental space. Southern countries can then move towards a similar level of natural resource use. A simultaneous population policy will assist in ensuring that the amount of environmental space per capita, and in turn prosperity, is not put under pressure.

How consumption can, in fact, be delinked from natural resource use in both rich and poor countries by an "end-use" approach, by increasing efficiency, reducing dependency on transport, by carbon taxes, tradeable user rights and sustainable land use is the subject of the rest of this challenging study.

The issues, complex as they are, are clearly set out and explained in an illustrated text which many will find helpful in trying to face up to the inevitable future.

John Rowley

## INVENTIVE FARMING

### Sustaining the Soil: Indigenous Soil and Water Conservation in Africa

Chris Reij, Ian Scoones and Camilla Toulmin, eds
Earthscan, 1996, £12.50

Colonial wisdom used to be that African farmers were wanton destroyers of their environment. Today the pendulum has come back full swing, and we recognise that many African farmers use very sophisticated techniques of soil and water conservation.

This volume provides a very useful survey of the great variety of systems in use. As well as an overview history of soil and water conservation efforts in Africa, there are 27 case studies of traditional approaches from every part of Africa, mostly by African researchers. These range from planting pits in the Sahel and the Matengo highlands of Tanzania, through compost-rich planting mounds in Western Tanzania and Mali, to grass strips in Swaziland and stone and earth bunds on Ethiopia and Morocco.

All shapes and sizes of pit, mound, ridge and bund in soil and stone are in use, carefully varied according to local soil and water conditions, labour availability, crop needs and so on.

The overall impression is of a staggering variety and inventiveness that gives the lie to stereotyped ideas of African farming as stagnant. The truth is that when conditions are right, when prices are fair, access to markets good, and tenure secure, African farmers will often develop appropriate techniques and if they are successful they will spread spontaneously

Paul Harrison

## MORE SUCCESS STORIES

### Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance

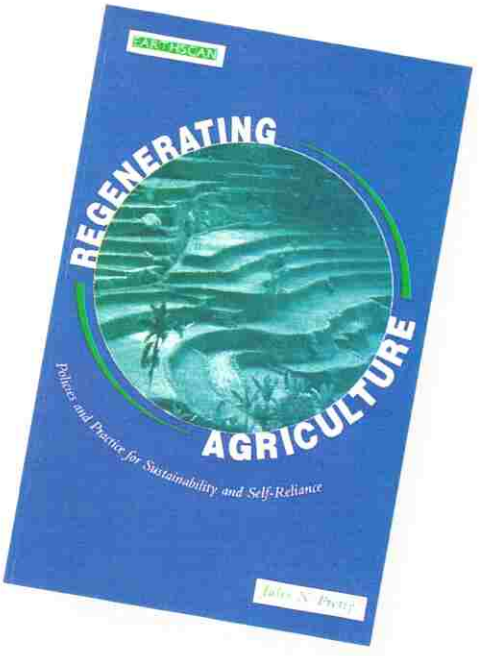
Jules Pretty
Earthscan, London, 1995, £14.95

This valuable book draws together new empirical evidence from a diverse range of rural communities to show the beneficial impacts of more sustainable farming practices. Twenty cases involving widespread success are supported by field – and community – level data from more than 50 projects and programmes in 28 countries.

Almost all of these successes have been achieved despite existing, biased policy environments that strongly favour 'modern' approaches to agricultural development, and at the same time discriminate against sustainability. The author argues that policies must now be more integrated and more directed towards alternative practice.

## OUTREACH PACKS

Three Outreach packs for schools on the subject of *Land Degradation* have been published by the New York based Outreach Project. Written and edited by Gillian Dorfman, with Sharon Kahkonen and James Connor, they deal with Soil Basics, Causes and Consequences and Some Agricultural Solutions. Highly practical and well illustrated they can be obtained from Dr James Connor, Outreach Director, Teaching and Learning Center, 200 East Building, 239 Greene Street, New York University, NY 10003, USA or Mr Richard Lumbe, Outreach Co-ordinator, Regional Office for Africa, UNEP, PO Box 30552, Nairobi, Kenya.



# Films

## WEALTH OR WILDERNESS?

In the late 1980s, a student at Mexico's Guadalajara University, received a Christmas card from American botanist Dr Hugh Iltis. The card depicted the perennial maize *Zea diploperennis*, an unusual variety, sadly believed extinct. Inspired by the image the student, Guzman, started to search.

For months he travelled the remote mountain wilderness of the Sierra de Manatlan on horseback, talking to peasant farmers. Eventually he heard stories about a strange sort of maize seen high in the sierra. In a remote valley he was shown the pasture where local cattle and goats were grazed – on several acres of perennial maize.

This discovery has great commercial potential, a fact not lost on the big seed companies who would like to produce the first commercial version of perennial maize. It could revolutionise agriculture in the United States and elsewhere. It could make ploughing in America's corn belt a thing of the past, and radically reduce the loss of top soil, although so far, no-one has yet managed to produce the commercial product.

Featured in a major new four-part television series on plant genetic resources and sustainable agriculture, this story, perfectly illustrates how the earth's wealth of myriad plant varieties present enormous opportunities for developing new crops and new sustainable techniques to feed a growing world population. But it also demonstrates how plant genetic diversity is being eroded away by human activities and how the hunt for specific genes with useful properties is creating conflict between growers and seed companies over the question of ownership and rights.

Going under the working title *Wealth or Wilderness?*, the series shows how plant genetic resources are vital to every aspect of our lives for food, clothes, shelter and industry. The series has been commissioned by the Consultative Group on International Agricultural Research (CGIAR) and is currently being produced by Acacia Productions in association with Television Trust for the Environment and the Japanese broadcaster, NHK.

Scientists and traditional farmers both have an important role to play in conserving plant genetic resources. Farmers have been manipulating, conserving and using plant genetic resources for millennia. Only relatively recently have scientists made their contribution, collecting and storing germplasm, breeding from often widely differing varieties from different parts of the world and incorporating genes from wild populations. The series underlines this need for a diversity of approaches to conservation, both in the field and in the laboratory and highlights new initiatives that encourage farmers and scientists to work together to share their knowledge and improve harvests.

Another programme in the series profiles the Russian, N. I. Vavilov, founder of the science of plant genetics and the world's first genebank. While Vavilov fell victim to the political and scientific in-fighting of the Stalinist era, his institute and its priceless plant collections nearly succumbed during the ferocious siege of Leningrad – many of the staff died of starvation rather than eat the stored seeds. But Vavilov's institute and his ideas survived, and today both still remain central to the modern science of plant breeding.

A final film looks to the future and the importance of plant genetic resources for developing new crops for food, medicines and industry, as well as improving existing ones. It asks who owns, and who should own, plant genetic resources. Should multinational corporations be able own plant genes or even specific varieties? What are farmers doing to protect their interests?

Today, as we clear forests and resettle indigenous people, replace traditional varieties with miracle seeds and expand our settlements onto agricultural land, there are real fears about the prospects for the conservation of our priceless plant genetic resources. *Wealth or Wilderness?* aims to create a more widespread understanding of these important issues and to show the steps now being taken to ensure the best possible legacy for the future of our global harvests.

Nick Rance

*Wealth or Wilderness?* will be completed and available for broadcast and non-broadcast use in April 1998.
Contact Nick Rance at TVE,
Prince Albert Road, London NW1 4RZ UK.
Tel: 44 171 586 5526,
Fax: 44 171 586 4866
Email: nick.rance@tve.org.uk

## HANDS ON

On the Peruvian terraces of the Andes, local farmers are unearthing the remains of Ancient Inca canal systems. Rediscovering and rebuilding the irrigation technology of an earlier culture is helping farmers in this region to more than double their agriculture output. In Malawi, local communities are learning a new technique, extracting oil from the Moringa tree which can be used to purify drinking water.

These are just two of the stories to be featured on BBC World next year in the *Hands On* slot, developed by TVE and Intermediate Technology, to give worldwide coverage to success stories of the sustainable use of science and technology by ordinary women and men.

Other stories planned include aquaculture (small scale fisheries) in Thailand, sustainable forest management by community organisations in rural Mexico, and the harvesting of the Uadegato plant in South America for the treatment of tumours and arthritis.

*Hands On* stories may be seen on BBC World as a regular feature of TVE's weekly magazine programme, *Earth Report*.

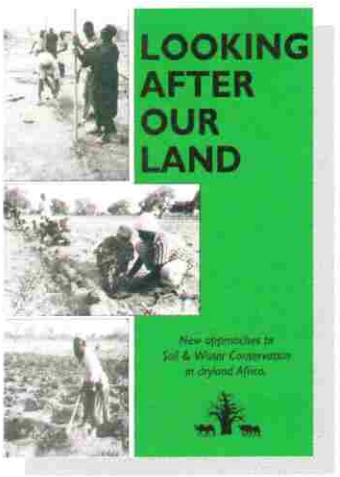
## ALSO AVAILABLE

*Looking After Our Land* is about the main lessons to be learnt from new approaches to soil and water conservation in Africa.

Six case studies are covered, two each from Burkina Faso, Kenya and Mali. They show how, in the wake of many failures, some success has been achieved in projects where participation of local people has been recognised as the crucial issue.

The video and accompanying book have been produced expressly for development workers in arid and semi-arid Africa on whose experience they are based but will also be of general interest to a wider audience.

Produced by North South Productions, both are the product of collaboration between Oxfam's Arid Lands Unit and the International Institute for Environment and Development's Drylands Programme.
For a copy of the video (£14.95) and book (£8.95) contact: Oxfam, c/o BEBC Distribution, PO Box 1496, Parkstone, Poole, Dorset BH12 3YD.
Tel: +44 (0) 1202 71 5555.
Fax +44 (0) 1202 71 5556.



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People & the Planet

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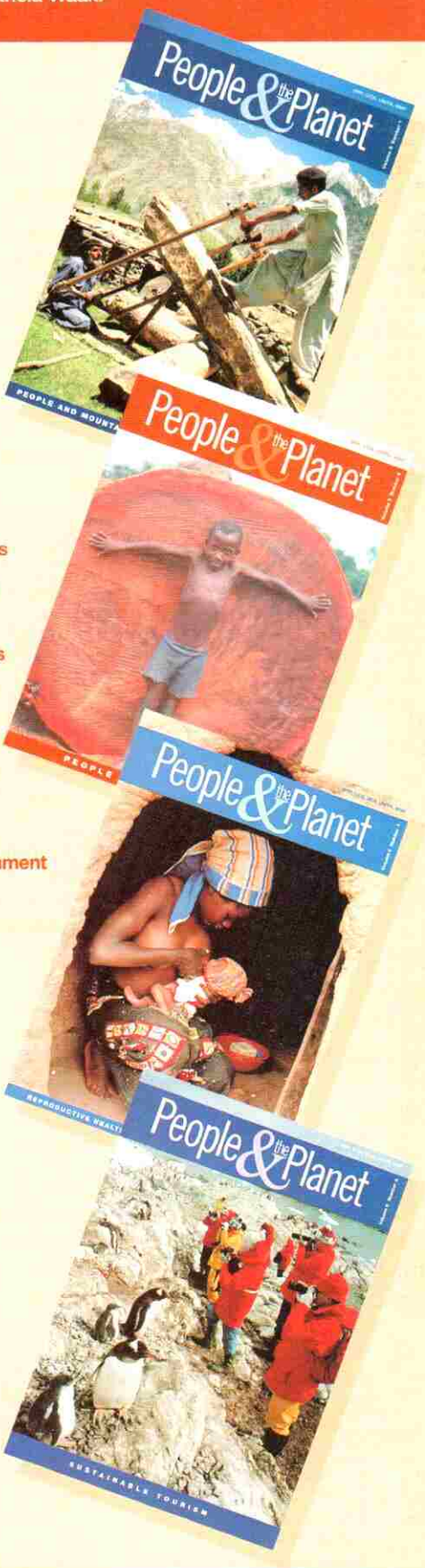


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